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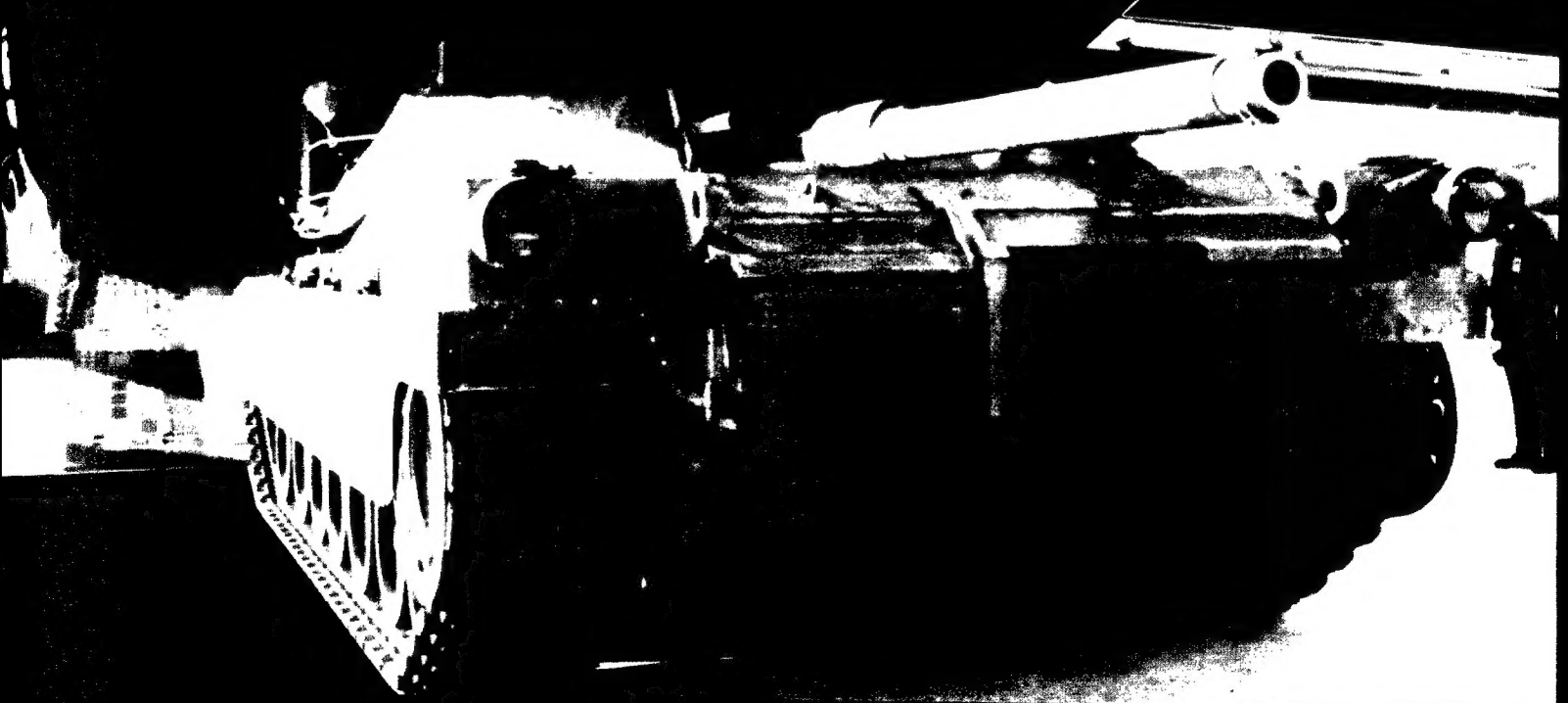
A WEALTH OF LOGISTICS LESSONS LEARNED

DESERT
SHIELD/STORM

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COVER:

Loading a U.S. Abrams A-1 tank on a C-141B for an airlift sortie to the Persian Gulf, September 1990, Robins AFB, Georgia.

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AFLMC NICHES ITS WAY INTO DESERT SHIELD/STORM HISTORY



Capturing Logistics Data

Major Stephen J. Hagel, USAF

The first installment of this article (Fall 1991 issue of the Air Force Journal of Logistics (AFJL)) provided an overview of several projects in-work at the Air Force Logistics Management Center (AFLMC) dealing with Desert Shield/Storm. This continuation of that article deals primarily with one of those projects, Analysis of Air Force Desert Shield/Storm Logistics Lessons Learned.

Part II

"Is there a thing of which it may be said, See, this is new? It has already been, in the vast ages of time which were before us. There is no remembrance of former happenings or men, neither will there be any remembrance of happenings of generations that are to come by those who are to come after them."

— Ecclesiastes 1:10-11

Before we begin discussing the lessons, I would like to address some concerns about lessons learned and the conclusions drawn from those lessons. First, learning from our past mistakes and capitalizing on innovations made in previous operations are very important, especially in light of today's cutbacks in defense dollars. However, as Terry Berle pointed out in the Fall issue of the Journal, let's not be too zealous in applying lessons from Desert Shield/Storm based solely on the lessons submitted to the Air Staff, the major commands (MAJCOMs), or the AFLMC in the Joint Universal Lessons Learned System (JULLS) or Air Force Lessons Learned System (AFLLS) format. There is a wealth of information behind those lessons which is not included in the write-up. We must also be careful not to attribute failure to logistics systems (symptoms) when we examine the contribution of objectives, strategy, and tactics (the cause). We do not have all the influencing facts surrounding the lessons.¹

Second, let's not look at the lessons as merely someone's opinion. All too often the comment is made that a particular lesson was just someone venting frustration. That may be true, but what was the cause of the frustration? We all have our opinions about what went right (or wrong) and how to improve current procedures. Let's not overlook these "opinions" because we think they were not real problems.

Third, it is important to remember that many of the lessons learned document problems which were not "war stoppers." This, in turn, begs the question, Why should we fix them then? We need to be cautious about ignoring these "minor inconvenience" lessons. If a policy or procedure is changed, or a problem is identified, we should apply the necessary resources to treat the cause and not "band-aid" the symptom.

Fourth, we had some problems; but we did win the war. The noted lessons are not to detract in any way from that fact or from the accomplishments of those who served in the operation at whatever level. It was a tremendous effort. As the Commander in Chief of USTRANSCOM, General H. T. Johnson, said "No nation in history has ever moved so much, so fast, so far."² Logistically, we moved more people and tons of equipment and supplies in a shorter time than at any other time in history. We must also be careful to draw the right conclusions from this war. Was it an indication of how we should fight the next war? Perhaps not; but that decision will be made by those with eyes on the "big picture." The next war may be different.

Fifth, from an historical perspective, as Jerome Peppers (a noted Air Force Historian) reminded me, these lessons will not be used by people today, but researched many years later in an attempt to apply lessons learned from Desert Shield/Storm to their current situation. We must ensure that as much detail as possible is included with these lessons for future historical perspective. Without that detail, those airmen in the future may draw the wrong conclusion.³

Now, after that bit of editorializing, let's continue the discussion of logistics lessons learned from Desert Shield/Storm. Keep in mind, we are reporting the information we received, not our opinion of the validity of the data. As of January 1992, the Center received nearly 1,400 logistics lessons in the AFLLS or JULLS format from virtually every command. AFLLS or JULLS is the approved format for documenting lessons learned for command post exercises and real-world operations. The format looks like this:

1. **JULLS NUMBER:** 12345-67890 (00001),
SUBMITTED BY (UNIT NAME).
2. **EXERCISE (OR OPERATION) NAME:**
3. **KEYWORDS:**
4. **TITLE:**
5. **OBSERVATION:**
6. **DISCUSSION:**
7. **LESSON LEARNED:**
8. **RECOMMENDED ACTION:**
9. **COMMENT:**

This software allows the user to enter the lesson learned, assign key words (such as logistics, transportation, war reserve materiel (WRM), pallets, etc.), provide a description of the event, and supply a recommendation to fix the problem.⁴

We excluded lessons which were not related to logistics and ended up with a total of 1,280 lessons. Of that total, 110 are classified lessons. Our final report to the Air Staff (Air Force Desert Shield/Storm Logistics Lessons Learned, project number

LX912097) covered the information by functional area. We deviated from that format for this article, having grouped the data into more generalized areas. We have also provided the information by category and by a generalized view of the types of lessons falling into each category. Perhaps future articles will cover each of the functional areas or specific concerns in more depth. The functional area directorates (Logistics Plans (LGX), Transportation (LGT), Supply (LGS), Maintenance and Munitions (LGM and LGW), and Contracting (LGC)) reviewed the database and categorized the lessons in logical divisions for each of their respective areas. (These divisions by functional areas do not treat the whole spectrum of logistics, which would include civil engineers, food services, etc., but those are the functional directorates at the AFLMC.) Many of the lessons cut across functional lines and therefore are included in more than one functional area database. For example, communications affected each of the disciplines so it is included in each of their databases.

With that background of the project and the type and quantity of logistics lessons available, let's first look at some of the success stories from Desert Shield/Storm. Then we will take a longer look at the functional area lessons.

Success Stories

There are more success stories from this operation than what we mention here. You folks in the field probably have several of your own to tell, like some workaround accomplished at your deployed location or during the deployment. Someone probably needs to capture those innovative ideas as lessons learned. We may need those ideas next time we decide to deploy to the sand.

The CENTAF (or Centralized as some articles say) Supply Support Activity (CSSA) was a noted success story. By channeling Air Force requirements into a single location at Langley AFB, Virginia, it significantly improved requisitioning capability for the area of responsibility (AOR). In many cases, providing centralized supply support through the CSSA dramatically improved the overall support to the region by receiving the request via satellite, forwarding that request to the proper supply center, and processing the transaction. Add to this improved supply requisitioning process, a quicker way to get the part to the AOR, and we have another success story—Desert Express/European Express.

Desert Express/European Express contributed greatly to a high mission capable rate. Rapid movement of this high priority cargo was vital. In many cases the Express responded to the immediate needs of the customer to keep the aircraft mission capable.

Prepositioning programs also paid big dividends. The prepositioned equipment and munitions provided an initial boost to the war-fighting effort. These programs of five land-based sites and three afloat prepositioned ships reportedly saved over 1,800 airlift missions. It was estimated that 25% of the vehicles used in Desert Shield/Storm came out of these prepositioned stocks.⁵ Although initially noted as a problem, the Harvest Falcon/Eagle/Bare assets proved to be successful programs for the support of our troops.⁶

Desert Shield/Storm allowed the opportunity to test some procedures that had not been tested in some time. Civil Reserve Air Fleet (CRAF) procedures, mobilization, and load departure messages were all tested in this operation with varying degrees of success. New weapon systems were also tested in combat

environments and, from what we read, performed extremely well.

Those are a few of the noted successes of Desert Shield/Storm. Unfortunately, the business of lessons learned is generally more on the negative side—you know, what went wrong. Yet, even in failure, we can find something good. If nothing else, we identified problem areas we need to fix before our next conflict.

Common Items

There were some lessons which were common to several of the functional disciplines. These common lessons can be divided into several categories: communications, automated data processing (ADP), chemical warfare defense equipment (CWDE), personnel issues, and visibility.

Communications

If we had to pick one category as having the greatest number of lessons associated with it, that would have to be communications. Although not specifically related to logistics, the applications to a successful operation, deployment, employment, and redeployment are easily perceived. There were over 300 lessons dealing with communications, interoperability, and related issues.

Lack of communications, such as telephones, radios, secure lines, and fax machines, hindered operations, especially in the early stages. Whether we were on the deploying end of the operation or at some remote site far from "Western Civilization," we probably felt the crunch from too few communications systems.

As in the case with every operation of this magnitude or even during major exercises, the AUTODIN lines rapidly became saturated with message traffic. What used to be processed as "Routine" now became "Ops Immediate." This elevation in message priority caused a "cease and desist" message from the CINC. Evidently, they were having difficulty receiving all their messages in a timely manner as well. It is a law of nature that when everything becomes priority, nothing is priority. The good news from all of this is that with AUTODIN backing up, fax machines played a new role in this deployment and subsequent operations, providing accurate information in both normal and secure modes with reasonable timeliness.

"Need secure communications for our units."

— Just Cause & Urgent Fury

Secure communications were sorely needed during this operation. No matter how many a unit had, they still needed more. Especially early in the deployment, when information was sketchy and the operation was still "compartmentalized," secure communications with the MAJCOM was a must. Many of the systems at the units were antiquated, albeit better than none at all.

Insufficient radios were deployed to support the maintenance effort. The units also noted that the available radios often did not operate on the same frequencies. Lack of handheld radios also hindered early operations in the supply/fuels community.

Automated Data Processing

"Automatic Data Processing capability for logistics management must be introduced in a combat theater as soon as possible with adequate communications support and with the capability of interfacing with support bases."

— Vietnam

There were a considerable number of lessons surrounding ADP concerns. Automated systems used by aircraft maintainers increase the technician's efficiency and provide managers with accurate maintenance management information. Because the ADP systems are mainframe dependent, most maintenance organizations were without ADP hardware during the initial months of Desert Shield. We had limited ability to update home-station ADP systems and provide maintenance managers with timely information necessary for force sustainment. This problem was compounded further because there was no way of accurately keeping tabs on configuration management or time change items. The time change problem would be especially critical in the area of engine management.

Computer availability was also a problem. Some maintenance units did not deploy with computers and had to rely on other organizations for their computer support.

There were few reliable data and voice communications available to pass data back to the home front or in-theater. Interface, connectivity, numbers of computers, and downtime impacted all operations, especially supply and maintenance.

The Combat Supply System (CSS) was limited in application and could not support the requirements. Deployed units needed the full spectrum of the Standard Base Supply System (SBSS) capability, and CSS was not intended to operate that way. At times the hardware was unreliable. Other indications show damage occurred to the equipment in shipment. Still other instances indicate operator training was lacking. In addition, hardware was undependable and data extracted from it was often unreliable. Lack of familiarity with the system also hindered support.

COMPES LOGMOD-B provided little more than automated packing and load lists because of the notional taskings. There were also lessons learned regarding COMPES MANPER. COMPES did not work well in a notional environment such as Desert Shield/Storm.

CWDE

"There is a lack of CWDE for the theater and those deploying."

— Wintex-Cimex 87

There were over 50 lessons associated with CWDE dealing primarily in three areas: training, quantity, and accountability once in-theater.

Training. Training problems with CWDE stemmed from two sources. Many people who deployed were not originally assigned to a mobility position designated for a high threat area and therefore had no requirement for CWDE and no need for training. This created additional problems, especially with all the non-mobility personnel deploying in support of Desert Shield/Storm. Not only could they not receive training, but those requiring spectacle inserts could not obtain them before deployment.

The second deficiency was in the nature of training. Many personnel were not well trained for the environment to which they deployed. The Disaster Preparedness (DW) personnel at most bases made some heroic efforts to provide at least cursory training for all deploying troops, but it was still insufficient. The requirement for CWDE training increased greatly at most of our units; in fact, in at least one instance, to double the amount.

Quantity. There were CWDE shortages in all MAJCOMs requiring a good deal of transshipping of bags from one location to the other to hold off until the next crisis. No secrets here. CWDE has been a problem before; only this time we actually had to deploy with and use the assets. Several lessons indicated overdue inspection dates, unserviceable masks, and torn waterproof bags. Some masks were scarce (M17A1/A2), and others were not available (MCU-2/P). Additionally, decontamination kits were defective (M258A1). Some of the Military Airlift Command (MAC) aircrews did not have atropine injectors available.

Accountability. Control, accountability, and availability of CWDE was lacking. There was confusion on deployment policy and procedures and reporting procedures. This led to multiple agencies reporting on the same assets.

Personnel

People make or break any operation. In Desert Shield, there were a considerable number of personnel issues. One of the main areas identified by the lessons learned was the problem associated with deploying personnel who were not in mobility positions. Under this operation, there were numerous calls made for additional personnel as well as for unit type codes (UTCs) from units who had not been tasked under any OPlan or who had not been required to maintain that capability by their Design Operational Capability (DOC) statement. This caused problems downstream in many areas, especially CWDE, mobility bags, and weapons. The concern was deploying individuals who had not been trained in weapon use or the operation of their chemical gear, and who did not have the proper equipment and clothing. Individuals not scheduled for deployment under any OPlan or DOC statement did not have (nor are they required to have) the proper clothing to deploy to the Southwest Asia AOR. This required purchasing the proper clothing or, in many instances, deploying without the required gear. Additionally, with so many non-mobility personnel deploying, the units had difficulty sourcing the proper number and type of mobility bags.

We noted from the lessons that the standard UTC packages did not contain the correct Air Force Specialty Codes (AFSCs) or the grade structure in adequate quantities. Lessons further pointed out that many personnel were not properly trained or otherwise prepared to accomplish the tasks for which they had been deployed.

One unique problem dealt with Air Force Reserve (AFRES) personnel volunteering for mobilization. In some locations, AFRES personnel wanting to volunteer for mobilization were at a disadvantage over those not willing to volunteer because the volunteers were afraid their employer would look upon them unfavorably. This placed the volunteers at a disadvantage with their employer over those who did not volunteer for duty.

Another problem was associated with piecemealing units together rather than deploying entire units. This led to problems with personnel accountability, morale issues, and other synergistic effects which occur as individuals from the same unit work together.

Visibility

"Pre-planning, identification of shortfalls, and prepositioning assets in the theater are needed for mobility, chemical warfare, and personal equipment shortages."

— Proud Eagle

Visibility issues had broad impact on virtually every area. Visibility over the assets we deployed affected logistics plans, transportation, supply, and maintenance. Visibility over WRM, to include munitions, was also a key logistics lesson learned. In all areas, the lessons indicate the systems or procedures we had in-place did not provide adequate visibility over assets.

Several lessons pointed out we not only did not have enough visibility over what assets and facilities were available, but we also did not have enough visibility over what condition those assets and facilities were in when needed. Units did not know what items to tailor from their deployment which would duplicate those prepositioned assets. MAJCOMs did not know what items would be available for their units' use once they arrived.

Visibility over personnel and cargo once they departed home station was also a noted area of concern. Some of this equipment did not have the proper mobility markings and therefore was left at the en-route location until someone had time to run a check to see where it came from or where it was going. A good percentage of the equipment moved via the transportation control number (TCN) instead of the unit line number (ULN), causing additional concerns.

We mentioned the success of Desert Express, but it too had problems. Visibility of assets was poor and caused delays and even duplication of requisitions.

Prepositioning assets, such as Harvest Falcon, paid big dividends. However, the program needed more visibility, management, and accountability of assets. For example, in some cases, prepositioned fuels mobility support equipment was unserviceable and required maintenance to make it fully serviceable again.

Those five areas were common to all the logistics functions. Let's look at the specific functional areas now, beginning with logistics plans.

Logistics Plans

We took a very broad approach to lessons associated with logistics plans. Essentially, if the lessons dealt with planning, mobility, deployment, or WRM, we placed them under the functional category of logistics plans. This broad look netted over 700 logistics lessons learned. The areas we will discuss are mobility, war reserve materiel, planning, and the Joint Operations Planning and Execution System (JOPES).

Mobility

There were approximately 100 logistics lessons dealing with mobility. Some of the more important areas not already covered include arming policy, aircraft information, sequencing, and procedures.

"Units deployed without weapons and flak vests."

— Just Cause & Urgent Fury

Arming policy. Reportedly, the arming policy for this AOR, and especially the numbers of non-mobility personnel deploying

to the AOR, were in conflict with some of the MAJCOM weapons policies. Many individuals were not previously weapons qualified or not qualified on the M-16. Additionally, weapons availability presented a problem. Weapons and ammunition had to be sourced from other units/MAJCOMs to provide for deploying forces. One other issue was the lack of control and storage to and from the AOR.

Aircraft information. Units were unable to ascertain the configuration of the arriving aircraft. Airlift scheduling and notification were not consistent. Messages were late in arriving or incorrectly identified the aircraft configuration. This levied an increased workload on the deploying units since they had to reconfigure the pallet structure and loadplans. This was especially true of the CRAF aircraft. There has been reference made to the "aluminum hailstorm" which occurred at some bases. Aircraft would arrive unannounced, at times in groups. Somewhat related to this was the inability of the unit to inform MAC of the weight and cube of the shipment. One lesson learned noted the cargo weight was understated by over 300% and passengers by 40%.

Organic movement also had its problems. A good deal of the equipment and personnel moved organically did not show up in the time-phased force deployment data (TPFDD). This caused problems in the Strategic Air Command (SAC) for outsized cargo, which cannot fit on a KC-10 or KC-135 organic aircraft. That equipment would have to be set aside for a later MAC movement.

Mobility sequencing. There were also lessons regarding mobility sequencing. For example at a bare base, the housekeeping facilities were not set up and people were arriving unannounced. This placed a great burden on already extreme circumstances. Several lessons suggested the Civil Engineering (CE) forces, personnel support for contingency operations (PERSCO) teams, logistics plans, and contracting officers included in the advanced echelon team should be some of the first to arrive and prepare a reception capability for the incoming combat forces.

Mobility procedures. Several lessons learned showed that AFR 28-4, *USAF Mobility Planning*, was not adhered to, such as not deploying medical records and on-the-job training (OJT) records. The need for a full mobility processing line was also noted. With the numbers of non-mobility personnel and those other mobility personnel requiring shots, legal services, medical checks, etc., during Desert Shield/Storm, the mobility processing line again served its purpose. Still, individuals deployed without proper equipment, clothing, training, or sufficient preparation. Additionally, the flow of information was not as practiced or planned (receipt of FRAG, levy flow, and air tasking order (ATO) to complete the schedule of events). To enhance some information flow, load departure messages were reinstated to have some visibility over what ULNs departed the bases.

"We do not train as we actually went to war."

— Vietnam, Just Cause, & Urgent Fury

There were several lessons which indicate we still do not train for deployment the way we actually deploy. This was related to several other lessons in mobility, plans, and JOPES. Forgetting plans and procedures at the beginning of operations creates confusion. Command post exercises (CPXs) and field training exercises (FTXs), as well as operational readiness inspections (ORIs), should have the same procedures as used in real-world operations. Mobility simulations show up in actual mobility

movements. People are unprepared. Equipment is shorted. Bags are not ready. Wills and powers of attorney get changed.

WRM

There were approximately 125 logistics lessons dealing with war reserve materiel. We mentioned earlier that WRM prepositioning programs were successful; however, they were not without problems. In the areas of clothing, fuel tanks, vehicles, and munitions, there were several lessons which indicate that insufficient stocks were available. In other cases, if the stocks were available, they may have been malpositioned.

Certainly not all of the WRM which was prepositioned or sent into the AOR was inoperable; however, there were enough lessons to merit a mention of problems associated with equipment or vehicle failure. Many of the components we preserve on vehicles and equipment were found to break after only a few hours or days. Some of this was attributed to climate, some to shipping, and some to neglect. As might be expected, there were instances of poor shipping of the WRM equipment. There were also lessons mentioning keys and technical orders were not included with the equipment when shipped (or in storage).

Plans

There were approximately 150 logistics lessons dealing with planning.

"Connectivity with the units needs improvement. They were tasked verbally with a hard copy to follow. There were many changes from what was tasked to what actually deployed."

— Just Cause & Urgent Fury

Telephonic taskings. Initially, there was a great deal of telephonic taskings for the units. Units received taskings from several different sources which were at times in conflict. The telephonic taskings often came from the MAJCOM functional managers, sometimes as a "heads-up" for the unit. These "heads-up" notices were initially appreciated by the units as they responded as rapidly as possible. Many times the advanced warning was right on target; however, there were numerous lessons which detail that the telephonic taskings were not always in agreement with the later published time-phased force and deployment list (TPFDL). UTCs, ULNs, aerial ports of embarkation (APOEs), numbers of personnel, and short tons differed. In several instances, the equipment or individuals had already deployed when notice was received to cancel the movement or change the destination. This caused problems with loadplanning and mobility processing actions. Additionally, units were also being called from other MAJCOMs with taskings for some of the bases' support personnel.

"Used non-standard UTCs for taskings."

— Urgent Fury

UTC concerns. Unit type codes and unit line numbers are used to designate a capability within an OPlan and label it as a unique entity. Unit type codes had several problems. First, the UTC did not contain all the necessary equipment or personnel necessary to do the job at the assigned location. Secondly, units deployed with more than the standard UTC required.

A third problem was with non-standard and fragmented UTCs. The non-standard UTCs (—Z99) were developed for those instances where no UTC would fit the need. However, in many cases, the UTC did exist; it was just not tailored. Fragmented, or fragged taskings, were also prevalent, creating confusion.

APOE and en-route base findings. Taskings for a particular ULN or UTC did not flow to the en-route bases (or APOEs in all cases). This caused problems for en-route stops. Since the en-route location did not know who or what was coming, the en-route unit scrambled to make arrangements for passengers and cargo which remained overnight. When cargo was bumped for a higher priority shipment, tracking at en-route bases was also very difficult.

As mentioned, load departure messages were reinstated as a needed addition to this operation. As seen previously, though, the en-route stops were not always well-informed about what was coming to their location. AUTODIN lines were saturated as well, which caused some of the messages to be received after the aircraft had arrived at the destination.

Some units are not properly manned to be APOEs, and some units not previously identified as APOEs were selected for that function in Desert Shield/Desert Storm. People were tasked from some of these APOE sites which further robbed them of valuable assets needed to support the APOE function or the deployment.

JOPES

"JDS not used until redeployment. We had a lack of visibility over what was going on during the operation and what airlift was available."

— Just Cause & Urgent Fury

There were approximately 100 logistics lessons dealing with the Joint Operations Planning and Execution System/Worldwide Military Command and Control System (JOPES/WWMCCS) environment.

Keeping up with the changes. JOPES was unable to keep up with all the changes. Airlift information, TPFDD changes in ULNs, ports of embarkation (POEs), and required delivery dates (RDDs) saturated the system and the information could not get to the units fast enough. The execution portion of JOPES was slow in this type of ad-hoc environment. It could not keep pace with the aircraft schedule changes dictated by the MAJCOMs and CINCs.

Operability and access. Without regular use and access, JOPES is a difficult system to operate. It requires systems expertise and there just are not many individuals with the necessary talents. It comes down to a matter of training and workstation availability. Few individuals had the required training for this operation; and capabilities within JOPES, such as the non-unit option, were noted as suffering from a lack of familiarity on the part of the operators.

In a like manner, access to the WWMCCS is equally vital. Many of our bases do not have access to a WWMCCS terminal. Some of the MAJCOMs do not have access or only have limited access to WWMCCS. Additionally, not all water ports have access to JOPES or even a WWMCCS terminal.

Close hold problems. This operation began as a compartmentalized or channelized project and remained as such for weeks. Not all MAJCOMs had the necessary user identifications to enter the WWMCCS to access this compartmentalized plan. Units could not look at their taskings.

Destinations could not be discussed or placed on mobility markings. Dissemination of taskings and information via this special category (SPECAT) channel hindered responsiveness in some cases.

Transportation

Transportation looked at over 300 lessons learned. From these lessons the transportation team member selected five main areas: Cargo, information flow, 463L assets, vehicles, and movement of small UTCs.

Cargo

Problems encountered in identifying and tracking cargo accounted for the single largest area of transportation lessons learned. Although the observations within the lessons approached the problem from many different angles, the common theme was the inability of the current system to adequately provide cargo status. Procedures and documentation were cited as the most common source of cargo problems. To a lesser degree, security classification and communication between transportation agencies played a part in creating problems.

At the heart of this issue is the vast problem of frustrated cargo. During Desert Shield/Storm, hundreds of pallets remained at their port of debarkation because sufficient information was not available to forward the cargo to its intended final destination. Not only did the unit not receive the cargo it needed, but the frustrated cargo occupied limited space that made the port more congested, wasted valuable man-hours trying to determine its final destination, and often resulted in wasted resources, such as airlift, when the cargo was requested a second time by the using organization.

Information Flow

Procedures for requesting transportation were not well-known. Base-level interface with, and understanding of, other transportation agencies were the main contributors to this problem area. Specifically, the inability of the base-level traffic management office to provide its customers with timely and accurate information on all modes of transportation both within the Air Force (MAC) and outside (Military Traffic Management Command) caused confusion. Sometimes, the base-level people did not know "who to call"; and, at other times, the requested information was not available anywhere.

463L Assets

Observations suggest the lack of 463L equipment could have significantly impacted resupply efforts. The contention is that present assets could not have supported a sustained campaign. According to the lessons learned, there were shortages of 463L forklifts and wide body loaders; insufficient spare parts for the repair of existing assets; and not enough pallets, nets, chains, and other 463L equipment. It appeared that as pallets were unloaded, they never made it back into freight channels. Many of the pallets were used for makeshift roofs, floors, and walls.

Vehicles

Vehicles were second only to cargo in generating the most observations in the transportation area. Vehicles also produced

the widest array of comments, addressing subjects ranging from who was allocated what vehicles, to the lack of vehicle maintenance support kits, to vehicle sourcing procedures. Some of the observations, such as notifying a base of vehicle deployment and unit requirements for the 60K loader, are narrow in their impact on the Air Force. However, many have very broad implications and could potentially impact every unit that requires vehicles to accomplish their mission. A few examples are vehicle sourcing procedures, allocation of theater positioned equipment, and WRM heavy equipment failure.

Moving Small Numbers of Personnel and Equipment

The final transportation lessons were those associated with movement of small numbers of personnel and equipment. This included small UTC packages and non-unit-related personnel and cargo. Excessive man-hours spent, expensive modes used, and limited capability were some of the areas addressed in the observations and imply positive gains may be made through making existing processes more responsive to small movements.

Supply

The Fall edition of the Journal contained two articles that highlighted supply lessons from Desert Shield/Storm. The Supply Directorate at the AFLMC had a separate project which looked at over 300 supply related lessons. Captain Daly's article, "Supply Lessons Learned," covered not only lessons learned submitted in JULLS as we do in this article, but also used interviews and conferences to report the information.⁷ The second article, "Documentary on Desert Shield/Storm Supply Support" by Lieutenant Colonel Gunselman, also addressed some of the supply lessons.⁸ We will not summarize those lessons in this report; instead, we suggest looking back at those articles for a detailed discussion of concerns in the supply community.

Maintenance

The AFLMC Maintenance and Munitions Directorate reviewed 260 classified and unclassified lessons to date. Several maintenance areas identified as potential problem concerns were already highlighted in this article. Other areas of concern include engine management, ramp parking space requirements, support equipment, and communications.

Engine Management

The AF Special Operations Command (AFSOC) helicopter spare engine support was a problem. The T64 and T700 engines failed at a far greater rate than expected. To compound the problem further, minimal spare engines support was provided by the Army and Navy.

Collection of engine trend data was also a problem. Some units could not collect valuable engine trend data because forward operating locations lacked portable ground stations necessary for the Engine Conditioning Monitoring Program (ECMP).

A final example showed engine availability and engine status were not reported by all deployed locations due to lack of reporting systems and qualified personnel. Engine removals and reasons for changes were not tracked or reported. Engine health monitoring systems were not maintained since engine management personnel and equipment were not deployed to all operating locations.

Ramp Parking Space Requirements

"Ramp parking space was limited. We need to fully consider what we are doing to our APOEs before we dump airlift into them."

— *Just Cause*

The next area requiring attention is that of ramp or parking space. While we realize maintenance has little control over the available space, we contend that parking is critical for safety, resource protection, and efficient control of maintenance resources.

There were two main problems. First, better parking plans are needed at staging bases for transient aircraft loaded with munitions. Parking aircraft at staging bases without developed parking plans could lead to munitions safety hazards. Second, poor initial site surveys provided incorrect measurements of aircraft parking ramps. Accurate ramp measurements are needed to determine the exact number of aircraft the ramp can accommodate.

Support Equipment

Many lessons were associated with support equipment problems. We suspect problems in this area can be attributed to inadequate deployment plans, plans that have not been reviewed or updated, or the tailoring of plans to meet airlift transportation requirements.

Several pieces of test equipment and support equipment were cited as not being available. For example, the EF111A reported not having a memory loader verifier available to program the ALQ-99 computers. Other units reported not having sufficient numbers of portable oil analysis machines and NF2 liteall carts.

Complex repairs were also a problem for some units. Units could not support complex repairs with the basic tools with which they deployed. Several examples were cited to support this: special tool requirements to build up wheel and tires, special devises to wedge electrical wires, aerospace ground equipment (AGE), diesel engine tune-up kits, and engine RPM tachometers, to name a few.

Other lessons identified that powered AGE was not always in a condition ready for deployment. Powered AGE sourced from base warehouses and depots lacked key components/parts such as batteries and cables. The batteries and cables, usually removed when stored inside, were not replaced when being prepared for deployment.

Communications

The final category for aircraft maintenance centers around communications problems. One noted concern involved conflicting taskings between Numbered Air Forces and the MAJCOM. Two CONUS units, for example, received guidance on how deploying aircraft should be configured before departing for the AOR. When the aircraft arrived at their destination, they had to be reconfigured for different missions. This resulted in many wasted man-hours.

Finally, several units identified the need to connect European MAC units to the CAMS FOR AIRLIFT system. Location and status of C141 and C5 aircraft were slow in being updated in the system, and dual inputs were required in both the Core Automated Maintenance System (CAMS) and the Information Processing System (IPS).

Munitions

A total of 132 munitions lessons learned were reviewed from Operation Desert Shield/Storm. The most significant concerns reported by the ammo community were Emergency Ammunition Reporting for Logistics Action Programming (EARFLAP); prepositioned assets; Standard Air Munitions Package (STAMP)/Standard Tank, Rack, Adapter, and Pylon Package (STRAPP); and munitions shipments.

EARFLAP Reporting

"EARFLAP reporting needs improvement."

— *Wintex-Cimex 87*

EARFLAP reporting presented problems with inaccurate data reporting. Daily reporting was initially accomplished by "complete rounds" per AFR 55-55, *US Air Force Reporting Instructions*, and other MAJCOM directives. But when CENTAF requested specific build capability, units changed reporting procedures and reported by "components." This caused unacceptable delays because complete round EARFLAP reporting does not provide access to all components and therefore does not provide a true picture of the munitions build-up capability. Multiple weapon configurations had to be figured and reported manually.

Prepositioned Assets

Another major issue experienced by most MAJCOM/LGWs and transportation agencies involved prepositioned munitions; Tanks, Racks, Adapters, and Pylons (TRAP); and War Consumables Distribution Objective (WCDO) assets.

The lack of prepositioned assets at locations of planned use caused significant redistribution problems and delays. Levels of needed preferred munitions were not available and did not match the deployed forces' requirements. This aggravated an already overloaded transportation system because it added more problems in obtaining additional manpower, equipment, and material handling to move the assets.

Problems were noted at forward operating locations (FOLs) as well. When we did have adequate stocks at our FOLs, little thought was given to the possibility of having to redistribute those prepositioned assets to different locations.

STAMP/STRAPP

STAMP packages that were built for C-141s were not compatible with other types of aircraft (DC-8, 747, etc.); consequently, STAMP loads had to be reconfigured to meet aircraft profile restrictions. In addition, STAMP/STRAPP loads were not always used to their fullest capacity on C-141 aircraft. Portions of packages were left behind. Over time they had to be regrouped and resourced in the TPFDD.

Closely related to STAMP issues were the ineffective and outdated STRAPP packages that lacked multiconfiguration capability. Changes in threat and missions required rapid reconfiguration of tasked aircraft. Often, intratheater redistribution actions were essential to support the next day's Air Tasking Order (ATO). These actions were often accomplished under severe time constraints.

Munitions Shipments

Numerous problems and delays in shipping munitions occurred throughout the campaign. Within some countries, 30-day notification was required to move munitions within the country. At other locations, delays in movement occurred because of lack of a 24-hour-a-day operation. Still other delays were experienced because weapons storage areas were not constructed at all our FOLs.

Normally, Air Force munitions are shipped in break-bulk ships so do not require containerization; however, this was not always the case during Desert Shield/Storm. Containerizing munitions at some ports posed a serious problem because containers were unavailable. Several ships did not have adequate shoring lumber (dunnage). Consequently, ship loading was delayed and dedicated MAC airlift was required to deliver additional lumber to offset the shortage.

The bottom line is that preplanned capabilities were severely impacted because of inadequate transportation support. The type and condition of munitions vessels selected also have a direct bearing on how expedient the munitions outload will be. Since the Air Force does not presently use containers for munitions shipments, extensive coordination between major commands was required.

Contracting

Very few lessons were received discussing contracting efforts; however, we understand many of the lessons and concerns of Air Force contracting officers and NCOs were collected by CENTAF. One main area of concern was that contracting officers and NCOs were given little guidance about whom they were to support. Noted also was the need to have the contract agents in-place before all the people and equipment arrived. Of course, we also need to ensure our contractors have sufficient money to handle the needs.

Recommendations

"Be nice to your mother, but love your logisticians and communicators."

—Lt Gen Horner, from a briefing on Desert Shield/Storm

That folks, in a nutshell, was a summary of over 1,200 logistics lessons learned. There are many more categories and lessons which we chose not to include in this article. As in the first part of this article, we wish to thank all of you who submitted your lessons. It was a pain, but it will make some difference in the way logisticians will provide combat capability in the future.

Now the question needs to be asked, What will we do with all of this data? Good question! What will *YOU* do with it? For example, what will you do about mobility simulations in the future at your base? Will you continue to let them slide by?

Throughout this article, you saw lessons taken from other operations or exercises. Those listed were only a small sample of similar lessons learned. There are thousands of other lessons from annals in the dusty cabinets in military libraries and at the Historical Research Agency (HRA), Maxwell AFB, Alabama, many of which are still classified. I encourage you to do some of your own research into past campaigns and check it out. You'll find that we have learned a great deal from the past, but we continue to ignore some of these recurring lessons.

Again, some would say that these are just one individual's opinion and that these weren't showstoppers or even a real

problem. I don't intend to argue that issue. Remember too that we must ensure we have as much background on the lessons as possible so we do not err drawing the wrong conclusions from the data. What we did in this article was report the lessons we gathered from Desert Shield/Storm. We provided no recommendations and few opinions about the lessons. We lay them out for your action and information. If you had these or related troubles, now is a good time to correct them. We also hope that by adding some historical perspective to it, you'll understand that lessons do recur.

We know there are additional lessons in the field which did not make it to the Center or to the Air Staff for whatever reason. In fact, we received a handful of them at the end of February. These lessons need to be documented and forwarded to your local historian, the HRA, or somewhere. Next time we decide to have a war or an exercise, document your lessons in AFLS or JULLS and forward them to your MAJCOM so they can be worked.

Now what? The lessons will be archived at the Historic Research Agency. The Air Staff will maintain the data. The AFLMC will keep the database and update it until summer 1992. We hope that, in the future, there will be a central focal point appointed to gather *logistics* lessons in the future. There are many efforts underway to analyze the lessons from Desert Shield/Storm, and some of the concerns may have already been taken care of. After all, that's what lessons learned are all about, ensuring lessons are, in fact, learned.

"Study our past successes and failures—learn from them."

—Major Stephen Hagel

(The author wishes to acknowledge the team members for project LX912097, Air Force Desert Shield/Storm Logistics Lessons Learned. They compiled the data in their respective disciplines and provided the majority of text in the appropriate sections: LGC - Capt Bill Hauf; LGM/W - Capt Scott Anderson, Capt Lois Schloz, CMSgt Ben Pate, and CMSgt Al Richardson; LGS - Capt Ray Daly; LGT - Maj Milt Siler; and LGX - Capt Janice Irving and SMSgt Penny Lynn.)

Notes

¹Berle, Col Terence H. (Ret USAF). "Be Wary of Revisionism," *AFJL*, Fall 1991, Vol XV, No. 4.

²*Air Power History*, Fall 1991, "Air Power in Desert Shield/Desert Storm. Part I," "The Logistics of Air Power Projection," Dr William Suit.

³Peppers, Jerome G., Jr. Personal letter to author; *Military Logistics: History of United States Military Logistics, 1935-1985*, Logistics Education Foundation Publishing, 1988.

⁴*Joint Universal Lessons Learned System (JULLS) version 3.10 User's Manual*, April 1990, Department of Defense Training and Performance Data Center, 3280 Progress Drive, Orlando FL 32826-3229.

⁵*Air Power History*, Fall 1991, "The Logistics of Air Power Projection," Dr Suit.

⁶*Air Power History*, Fall 1991, "Desert Shield/Desert Storm: An Overview," Lt Gen Charles A. Horner, USAF.

⁷Daly, Capt Raymond T., Jr. "Supply Lessons Learned," *AFJL*, Fall 1991, Vol XV, No. 4.

⁸Gunselman, Lt Col John H. "Documentary on Desert Shield/Storm Supply Support," *AFJL*, Fall 1991, Vol XV, No. 4.

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READER EXCHANGE



Dear Editor

Finally, someone took exception to the Fall 1990 *AFJL* article, "Logistics Support Limitations in the Vietnam War: Lessons for Today's Logisticians," by Major Benjamin L. Dilla, USAF. I had planned to write a rebuttal to this article, but kept putting it off. I congratulate Colonel Terence Berle ("Be Wary of Revisionism," Fall 1991) for his tactful yet explicit critique.

I too found Major Dilla's conclusion (that logistics constrained the Vietnam War effort and contributed significantly to US failure) unsubstantiated by the facts or the documents he cites. In addition to the material cited by Colonel Berle, another of Major Dilla's sources (Jerome Peppers' *Military Logistics: A History of United States Military Logistics, 1935-1985*) reaches a different conclusion. On pages 228 and 229, Professor Peppers states:

Nevertheless, the logistics systems did work and work with effectiveness. Field commanders, and individual troops, indicated in various ways that, with minor and

short-term exceptions, their needs were met to a high degree. The faults we find as we complete our exploring of the logistics of this war should not obscure that fact. The logistics systems did meet the objective of supporting the troops in combat!

For a very enlightening perspective on the subject of logistics and Vietnam, I highly recommend General John E. Murray's article, "Vietnam Logistics: Who's to Blame," in the September/October 1984 issue of *Military Logistics Forum*. General Murray was the US Chief of Logistics in Vietnam in 1972 and, after the American withdrawal, the US Defense Attache in Vietnam until 1974. As this article reveals, there are many different ways of looking at Vietnam logistics. Revisionism should not be one of them.

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Most Significant Article Award

The Editorial Advisory Board has selected "Documentary on Desert Shield/Storm Supply Support" by Lieutenant Colonel (Col Sel) John H. Gunselman, Jr., USAF, as the most significant article in the Fall 1991 issue of the *Air Force Journal of Logistics*.

Air Power in the Persian Gulf: An Initial Search for the Right Lessons

William Head, Ph.D.

On 1 August 1990, Iraqi and Kuwaiti diplomats broke off negotiations over oil pricing, Kuwaiti loans to Iraq, and Iraqi claims on Kuwaiti territory. At dawn the next day, a powerful Iraqi army invaded its tiny neighbor to the south. By the 4th, Kuwaiti resistance had crumbled and Iraq had taken control of the capital, Kuwait City.¹

Desert Shield

On 6 August 1991, the United Nations (UN) voted to place an international embargo on Iraq. The next day, fearing an Iraqi invasion of America's Middle-Eastern ally, Saudi Arabia, and determined to eventually free Kuwait, President George Bush, at the Saudi's request, deployed the first US troops, warplanes, and ships to the Persian Gulf region. The first American elements deployed were 24 F-15Cs from the 1st Tactical Fighter Wing, Langley AFB, Virginia, and three E-3As from the 552d Airborne Warning and Control Wing, Tinker AFB, Oklahoma. In retrospect, Iraqi President Saddam Hussein's veiled threats of an invasion of Saudi Arabia proved to be a bluff, for his forces never attacked the Saudis and provided the allies nearly six vital months to build up their forces in the area to over 700,000.² This is certainly one factor which cannot be overlooked in explaining why the allies won so easily. One can only imagine the difficulty of trying to deploy troops and supplies in a hostile combat environment whose security was in doubt.

On 8 August, the Iraqi Parliament declared Kuwait to be the nineteenth province of Iraq. President Bush, while waiting until the 22nd to call up US military reservists, had apparently decided on a military solution to the crisis even as early as 4 August. By the end of the month, a formal 28-nation alliance, including countries from Europe, Asia, the Americas, and the Middle East, had been molded by the President to confront the forces of Saddam Hussein.³

In September and October, events focused on the Iraqi seizure of Western and other coalition hostages in Iraq and their embassies in Kuwait. In spite of lame efforts to use the hostages for propaganda purposes, Hussein finally agreed to release these

foreign nationals.⁴ This is another critical factor in the ease of victory. Without a screen of hostages to be concerned with, allied forces could bomb any target they wished without hesitation. This may not always be the case in the future. Other dictators and enemies may use American civilians as a screen to prevent attacks. There is at least some past evidence to suggest such a possibility in the future.

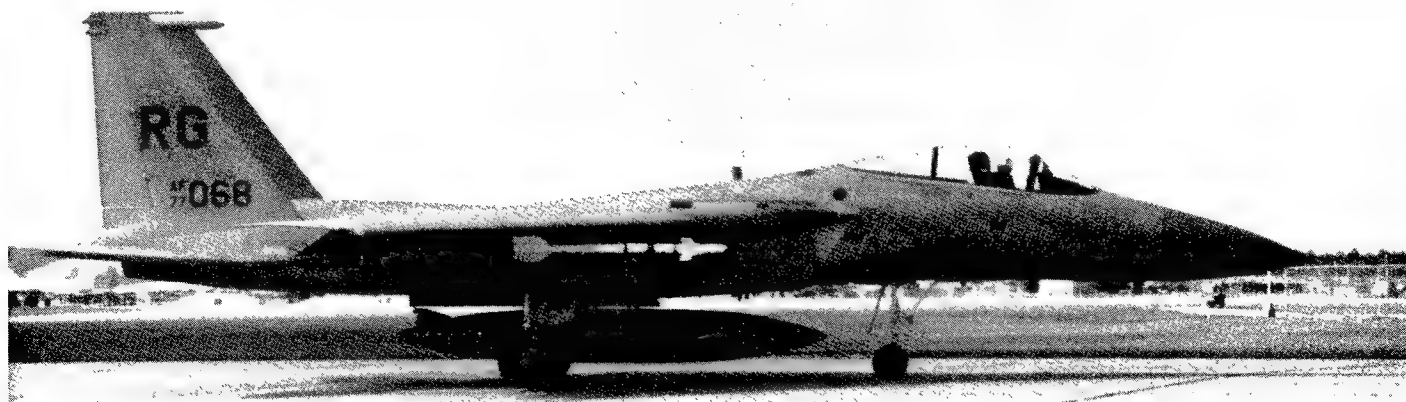
At the end of November, after receiving assurances from the coalition allies, US officials spearheaded the passage of a UN Security Council resolution allowing Iraq six weeks to pull its forces out of Kuwait. Then, on 12 January 1991, in an historic and controversial vote, Congress, after two days of intense debate and by a close margin, granted the President authority to wage war in the Persian Gulf.⁵

In spite of last minute diplomatic efforts in January by Secretary of State James Baker and UN Secretary General Perez de Cuellar, the 15 January 1991 deadline arrived without resolution of the conflict.⁶

The battle lines were now drawn. Between 8 August 1990 and 15 January 1991, the US undertook a rapid and massive buildup of men and materiel that, by the time the air war began on 16 January, had deployed nearly 440,000 troops, 1,200 tanks, 100 warships (6 aircraft carriers), 1,800 aircraft (1,229 combat aircraft), and 1,700 helicopters.⁷ Before ground operations commenced on 23 February, these numbers grew to 527,000 troops, 2,000 tanks, and 150 warships, while aircraft and helicopter totals remained constant. Allied coalition forces ultimately numbered over 700,000 men and women as well as 2,790 aircraft and over 3,200 tanks and armored vehicles.⁸

Desert Storm

Early on 16 January 1991, the first American jets, preceded by Tomahawk missiles launched against enemy air defenses, took off for attack runs against Baghdad and other targets in the Persian Gulf. They faced an enemy that at the beginning of the war had the fourth largest army in the world and sixth largest air force with nearly 1,000 modern, mostly tactical aircraft.⁹ As



F-15C "Eagle" preparing for take-off during raids on Baghdad.

conceptualized by US Air Force planners, the air campaign was designed to prevent Iraqi disruption of allied air operations, destroy the Iraqi offensive air threat, isolate and wear down the Iraqi field army, and support allied ground force operations. This was done in four phases:

Phase I—Gain air superiority; destroy Iraqi nuclear, biological, chemical and SCUD capability; disrupt Iraqi command and control.

Phase II—Suppress air defenses in the Kuwaiti Theatre of Operations (KTO).

Phase III—Continue to service Phase I and II targets as needed, and shift the emphasis to an attack on the Iraqi field army in the KTO.

Phase IV—Support allied ground operations.¹⁰

In what later became known as the 100-hour war (the ground war), air operations alone carried the war to the enemy for 39 of the 43 total combat days of the conflict and played a key support role in the four days of ground operations which liberated Kuwait. By the end of allied operations on 27 February 1991, their air forces had flown over 109,876 combat sorties (66,128 US) and nearly 125,000 overall sorties, losing only 51 planes, 38 combat aircraft, with 29 being American. The enormity of this effort can be appreciated when compared to similar numbers from the air war in Vietnam. From June 1965 to August 1973, B-52s flew 125,479 sorties, while from 1963 to 1975, tactical aircraft flew over 2,000,000 sorties. However, the US flew about the same number of sorties and expended more bombs in six weeks in the Persian Gulf War than during any single year in Vietnam.¹¹

In two of the most significant air battles of the Southeast Asian War, the Linebacker I (10 May - 23 October) and II (18 -29 December) campaigns of 1972, US Air Force B-52s flew only about 900 sorties dropping 23,300 tons of bombs. Our B-52Gs flew the same number of sorties and dropped the same amount of bombs in six week of the Gulf War.¹²

With the use of "smart bombs" and superior technology, raids by the allies' tactical aircraft were far more effective and efficient than similar attacks had been in Vietnam. In short, it took fewer bombs to do more damage per capita in the Persian Gulf War than in Vietnam.

Spearheaded by 1,229 American combat aircraft, including F-15 "Eagles," F-16 "Falcons," F-111 "Ravens," F-117A Stealth fighters, B-52 "Superfortresses," A-10 "Thunderbolt IIs," F-18 "Hornets," and A-6 "Intruders," the allies dropped an unprecedented number of the most sophisticated bombs in history on Iraq and Kuwait. Supported by such allied aircraft as "Harriers," "Tornadoes," and "Jaguars" from the British, French, and Italian Air Forces, they wrought massive damage on the Iraqi military. The destruction was so great that the air campaign, augmented by the UN embargo, provided allied ground forces with a severely weakened enemy and led to one of the shortest and most decisive ground campaigns in history. Those 60,000 Air Force (54,800) and Naval Air officers and enlisted personnel were justifiably proud of their efforts.¹³ At his 15 March 1991 Pentagon briefing, General Merrill A. "Tony" McPeak, Air Force Chief of Staff, went so far as to declare, "My private conviction is that this is the first time in history that a field army has been defeated by air power."¹⁴ While a bit of an overstatement, it demonstrated the vindication that the leaders of allied air power believed they had attained.

These American air power forces were located at 25 sites in Saudi Arabia and on six carrier task forces in the Persian Gulf and the Mediterranean Sea. The Air Force alone was supported by "\$1.3 billion worth of bare base assets" as the result of operation "Harvest Falcon." Not only did these forces crush the enemy but, to quote one of the myriad of TV experts, "In 24 hours the Air Force sponged away all the bad memories of Vietnam." While overzealous to be sure, the preeminent role of American and allied air power cannot be ignored.¹⁵

Indeed, air power did the lion's share of the fighting from 16 January to 23 February. In the end, air power destroyed, damaged, or rendered useless vast numbers of Iraq's nearly 1,000 aircraft, 4,200 tanks, 4,000 artillery pieces, and 545,000 troops in the Kuwaiti Theatre of War. Not only did coalition aircraft surprise the Iraqis by the timing and thoroughness of the air assault, but they shocked Saddam Hussein by the mere fact they attacked at all. The swift and decisive strikes not only garnered the allies early air superiority, but later allowed coalition air power to systematically annihilate enemy ground communications, command structure, logistics support, and finally the ground forces themselves. Ultimately, America's overall resolution and military precision completely stunned Iraqi political and military leadership.¹⁶

Lieutenant General Thomas Kelly, Director of Operations for the Joint Chiefs of Staff (JCS), poignantly summed up the effectiveness of the air war during his 20 February 1991 Pentagon Briefing. When asked about a statement by the commander of the Iraqi's elite Republican Guard that the bombing had had little effect on his troops, General Kelly disagreed vehemently citing the destruction of 1,400 of Iraq's 4,200 in-theatre tanks. He concluded:

No, I wouldn't [agree]. As a matter of fact, were I the commander of the Republican Guard—that's one of the other things I thank God for, that I'm not. . . .¹⁷

American Objectives and Air Power's Role

Make no mistake, while the official reason for this War was the liberation of Kuwait, and that was an important consideration, there were several other original objectives that ultimately superseded this announced goal. First and foremost was the destruction of Iraqi military power, especially her nuclear, chemical, and bacteriological capabilities. From the outset of Desert Shield, the President openly recognized the significance of these objectives. In his 11 September 1990 speech to Congress, he set down as America's primary goal:

To curb the [Iraqi's] proliferation of chemical, biological, ballistic missile, and above all nuclear technologies.¹⁸

Almost as important was the preservation of Saudi Arabia, America's primary source of oil in the region, and Israel, America's primary ally in the Middle East. In the end, the US leaders believed a victory over the Iraqi military would topple Saddam Hussein from power to be replaced by a relatively moderate and semi-democratic regime that would act as a buffer and counterweight between Syria and Iran. While, by the end of the war, this goal was not achieved, these same officials still hoped the lesson of this War would not be lost on other potential regional strong men like President Assad of Syria.

Without question, many of these goals were reached. However, the destabilization of the region leaves the ultimate outcome still in doubt. Of course, the centerpiece of the military objectives, the destruction of Hussein's war machine, has been generally achieved; and, had CENTCOM Commander General

H. Norman Schwarzkopf had his way, it could have been completed in total.

To realize these goals, the massive power of the allies was brought to bear against Iraq. As of 15 March 1991, the allies had dropped 88,500 (74% by the USAF) total tons of bomb ordnance, 6,520 being precision ordnance or smart bombs (90% USAF). They destroyed or captured nearly 3,800 of Iraq's 5,500 tanks (4,200 in Kuwaiti Theatre of Operation/KTO), 2,100 of her 3,500 artillery pieces, and 54 major railroad or highway bridges. Of a total of 1,000 Iraqi planes, 234 were destroyed, 42 on the ground, 35 in air-to-air combat (31 by Americans), and 16 by ground forces. Another 122 were interned in Iran. In addition, of Iraq's 594 aircraft shelters, 375 were damaged or destroyed. This included the destruction of 141 more Iraqi aircraft housed in the shelters, bringing the total Iraqi Air Force attrition to 234. By early February the rest dared not fly for fear of being shot down. Two which tried to fly after 1 March were shot down. Most of the planes and tanks taken out of action were Iraq's most modern military hardware such as T-72 tanks and MIG-29 jet fighters.¹⁹

Iraqi SCUDs were virtually wiped out as well. Eighty-six SCUDs were launched by the Iraqi military—46 against Saudi Arabia and 40 against Israel. The allied air attacks were so successful against elusive targets that, while 49 were launched in the first 10 days of the war, only 36 were launched in the last 33 days. With successful deployment and use of Patriot missiles, most of these launches were ineffective, especially those fired toward the end of the war. Add to this the fact that over 300,000 soldiers, many of her best, were killed, captured, or wounded during the war, and a clear picture of the devastation wrought by allied, especially American, air power is evident.²⁰

Even though we now know their nuclear and chemical/bacterial capabilities, supposedly destroyed in the first week of the air war, were not, leading to current threats of a resumption of the war on the part of President Bush, the overall effectiveness of American air power is still not diminished. One early account had estimated that even with the money to pay for components, Iraq's nuclear development was set back three to five years. This, however, seems now to be a far cry from reality, but one which can, even now, be remedied by the reemployment of US air power.²¹

The Meaning of the Air War

In reading all the statistics, it should be of significance to those concerned with air power that over half of Iraq's total armed forces and most of her tanks were destroyed in this war—the vast majority by air power. In addition, sizable portions of the biological, chemical, and nuclear facilities were at least hit by allied air forces. Most of this was accomplished in the first 39 days even before the ground campaign began. During the 100 hours of the ground war, many Iraqi losses were due to close air support aircraft such as the A-10s and helicopter gunships. These direct losses were augmented by desertions and poor morale due to the constant aerial assaults by tactical fighters and B-52s. In a very real sense, air power not only set the table but served up the victory in this War. It was a military victory of such magnitude as to provide the opportunity for diplomatic success even if the diplomats failed to take advantage of it.

As the War came to an end, the US military as a whole, and the Air Force in particular, looked back with pride at the performance of its leaders, troops, and weapons. Most Americans hold vivid memories of the effectiveness of allied "smart bombs," Patriot missiles, tank killing A-10s, and Apache helicopters. Indeed, American technological success in this war

was unparalleled. As air power analysts and military experts look back at the role of air power in the Persian Gulf War, there are many lessons to be learned.

In retrospect it seems worthwhile to examine not only the course but results of the War using those primary, secondary, and public sources currently available. While in-depth primary research from the vast array of US and UN military documents produced by the War can only just begin at this time, an analytical essay looking at the strengths and weaknesses of the allied forces should serve as a valuable barometer of general trends and tendencies within the US military as a whole and specifically the US Air Force. Seeking lessons from the Persian Gulf War is a useful exercise as long as one does not overanalyze the events or draw hard and fast rules as too many analysts and military leaders did after the Vietnam War. Unlike the Gulf War, most of the so-called lessons of Vietnam were significant only if the US had fought the same war at the same time in the same place. In many respects, the advances and improvements in the US military since 1975 are not because of specific lessons from the war in Southeast Asia but because the character and opinions of present day leaders were formed by that war. In short, they were determined not to lose again.

The Vietnam Syndrome

One of the most discouraging notions to come out of the Persian Gulf War is that this was somehow a vindication for Vietnam. President Bush, from the outset, established this tone for the general public. His own experiences as a downed pilot in the Pacific in World War II and his perceptions of Vietnam colored his vision of the Persian Gulf War. On the night of 16 January 1991, as he announced the opening of the air war, he declared:

I instructed our military commanders to take every necessary step to prevail as quickly as possible, and with the greatest degree of protection possible for American and allied service men and women. I've told the American people before that this will not be another Vietnam, and I repeat this here tonight. Our troops will have the best possible support in the entire world, and they will not be asked to fight with one arm tied behind their back.²²

Five weeks later, during his announcement of the 27 February cease-fire, the President gleefully proclaimed that, "By God we've kicked the Vietnam syndrome once and for all. . . ."²³

Such sentiments struck a popular cord, one to which most military commanders ascribed. This wasn't surprising since the vast majority had spent their formative years in Vietnam and had bitter memories of what they believed were the shortsighted war policies of Presidents Lyndon B. Johnson and Richard M. Nixon. In a series of October 1990 interviews with General Colin Powell, Chairman of the Joint Chiefs of Staff; Lieutenant General Walter E. Boomer, Commander of US Marine forces in the Gulf; Admiral Frank B. Kelso II, JCS Naval Chief; and General Carl E. Vuono, Army Chief of Staff, the latter summed up all his comrades' feelings when he noted that:

The group of leaders who are in the key positions, we were all about the same rank during Vietnam days, majors and lieutenant colonels, and I think all of us were shaped by the low point in the military in the early 70s.²⁴

In December, General Powell once again alluded to the military leaders' general concern about the ghost of Vietnam. During a final inspection tour of the Gulf Theatre, the General declared that, once diplomacy fails, "you go in to win decisively, not to force people to the negotiating table." The statement was

an obvious referral to what he believed to be the mistaken policies of Vietnam.²⁵

The American public embraced these same concerns and were firmly convinced of the need to fight a "different" war in the Persian Gulf. It is why even Saddam Hussein tried to focus on America's Vietnam phobia as a possible trump card to intimidate the American population and influence public opinion against US commitment in the Persian Gulf region. One editorialist compared Hussein's strategy, in this regard, to Adolf Hitler's "Bluff and Bluster" tactics from 1936 to 1939 in Europe. During the Fall hostage crisis and even after, Hussein took every opportunity to warn the American public, most often in interviews with Western newsmen like Dan Rather, that a war with Iraq would be another long, bloody, and divisive struggle "like Vietnam."²⁶

The Realities of the Vietnam War

In spite of politically popular notions that a disloyal press and civilian political restriction on the US military cost us the war in Southeast Asia and the general public determination to avoid another Vietnam, I think most analysts would agree that these two wars were very different. Even though comparisons can be made, the dissimilarities are far greater. This was just as true for the air campaign as for any other aspect of the Gulf War. To quote Mark Clodfelter's article in *Air Power Journal*:

The Southeast Asian backdrop profoundly affected both the planning for and conduct of the air campaign against Iraq. Yet to say that Operation Desert Storm's remarkably decisive air war exorcised the demons that had plagued the bombing campaigns against North Vietnam would be premature. Although the efforts to apply the perceived lessons of Vietnam contributed greatly to air power's success against Iraq, the unique circumstances of the Persian Gulf war were equally significant in making air power a decisive weapon. Moreover, an analysis of Vietnam's impact on the Desert Storm air war reveals that a few ghosts from Southeast Asia continued to haunt—and leaves the suspicion that in dispatching demons from Vietnam, the Air Force may have generated a phantom from the desert.²⁷

It is worth focusing on just a few of these differences to provide a frame of reference. The most critical difference is the fact that, while the Vietnam conflict occurred at the height of the Cold War, the struggle in the Persian Gulf is the first major post-Cold War conflict. In Vietnam, US political leaders always had to be concerned with widening the war into a third world war with the Soviet Union and/or the People's Republic of China (PRC) as the enemy. East-West rivalries motivated the USSR and PRC to supply a constant stream of arms, materiel, and spare parts to their client ally. From the standpoint of American air power, one of the most significant items the Soviets supplied North Vietnam in abundant quantities was surface-to-air missiles or SAMs which wrought heavy losses on US aircraft. Conversely, after initial allied air attacks destroyed almost all of Iraq's SAMs, their anti-aircraft capability was very limited. This was even more significant since the Soviet Union, Iraq's primary suppliers of these sophisticated weapons, was ostensibly part of the 28 nation coalition and did not provide replacements. China stayed out as did most of the other major arms supplier due, at least in part, to the UN embargo. While Iraqi nighttime anti-aircraft artillery (AAA) fire was spectacular to see on the CNN evening news, its effectiveness was minimal compared to what the SAMs might have done.²⁸

President Bush recognized just how much the post-Cold War era changed the situation in the Persian Gulf. During his 16

January speech to the nation, he acknowledged "the great progress in ending the long era of conflict and Cold War."²⁹ Clearly he knew that the lack of Soviet supplies and arms for Iraq and Soviet intelligence on the Iraqi systems and defenses supplied to the allies was a great advantage which US forces did not have in Vietnam.

Other critical variations range from the obvious contrasts of weather, climate, and terrain to the technological advances which exceeded the predictions of even the most optimistic allied avionics advocates. From an air power standpoint, Vietnam confronted pilots and other support personnel with arguably one of the most difficult terrains and climates for bombing and locating enemy ground targets, and for aircraft wear and tear that US air forces have ever had to face. On the other hand, the Iraqi and Kuwaiti Theatres, allied aircraft attrition notwithstanding, provided coalition air forces with one of the best set of natural circumstances available in air war history. It is also worth mentioning that aircraft damage and fatigue problems unique to the area were efficiently and effectually remedied by well-trained Air Force field repair teams.

New electronic warfare, avionics, and weapon system packages have also made fighting an effective conventional air war easier. The Persian Gulf War was the most compelling confirmation of that fact. Allied pilots I talked to marveled at the precise firepower the instruments in their aircraft provided them. In addition, the structural toughness of these modern jets is remarkable considering the numerous minor hits they took without crashing. Similar structural and engine damage would have downed many of America's World War II, Korean, or Vietnam vintage aircraft.

Last, but not least, the Gulf War, although against a Third World state, was a classic conventional war fought along the lines of strategies and tactics developed in World War II, Korea, and the Arab-Israeli Wars of the previous four decades. America's military is very good at conventional combat. This is particularly true with regard to use and effects of air power since in the Gulf region, as in each of the mentioned conflicts, the critical turning points of the war came when air superiority was attained. Throughout the subsequent concluding phase of all these wars, air superiority, although it did not win the war alone, proved an essential determining factor in the outcome. In Vietnam, in spite of US air supremacy, the war could not be successfully prosecuted.

This fact can, at least in part, be explained as Dr Douglas Pike does in his book *PAVN: People's Army of North Vietnam*, by an analysis of the nature of the Vietnam conflict. For the most part, the conflict was not conventional; and even when it did finally take on that characteristic, it did so at the choosing of the enemy and not the Americans. According to Pike, the Vietnamese Communist leaders conceptualized their struggle, or *dau tranh minh*, as the pincers on an ice tong. The North fought the war on two levels—one a sociopolitical and economic struggle (political or *dau tranh chinh tri*) and the other a military or armed struggle (armed or *dau tranh vu trang*). In this regard, they undertook action against the allies in three ways: *dich van*—action among the enemy; *dan van*—action among the people; and *binh van*—action against the enemy. Indeed, Dr Pike makes a powerful argument that American leadership never grasped the true reality of the war. He characterized US strategic policy as "Vincible Ignorance," or "you know you do not know that you do not know it, but you don't care."

In short, the American attitude toward war has always been that it is an occasionally painful social necessity, while to the Communist Vietnamese it was a total commitment to struggle.

Pike provides compelling evidence that the North Vietnamese Communists' resolution was almost inexhaustible and that they were willing and able to absorb large numbers of casualties. From the military standpoint this was due, in large measure, to the previously mentioned Soviet resupply of critical weapons. With these advantages they could, and did, carry on the war at both Da Chan levels alternating one to the other as circumstances necessitated.³⁰

George Herring, in his book *America's Longest War*, and Stanley Karnow, in his companion piece to the PBS series *Vietnam: A History*, argue that the war the US slowly but surely entered into, beginning in the late 1950s was, and had been an anti-colonial civil conflict aimed at purging Vietnam of foreigners and unifying the nation under an indigenous government.³¹

In spite of one's approval or disapproval of the resulting People's Republic of Vietnam, the war in Vietnam was the outgrowth of what became known in the post-World War II era as a people's revolution. It was clearly fought on various diplomatic, political, propaganda, military, and even economic levels using various means and methods with varying success. The almost exclusive employment of conventional weapons, strategies, and policies by the US, especially in the early days, simply could not ever completely destroy the Communists. In the end, even if the revisionists had been correct and full US power could have been brought to bear, there is no real evidence that this would have attained US goals. This is partly because US goals were not well conceived. Worst of all, in trying to help the South, American leaders sublimated South Vietnamese leadership structure, ultimately eliminating most of those necessary for the South to eventually protect and defend herself.³²

Certainly, this is easily contrasted from the circumstances in the Gulf conflict. Saddam Hussein, as President Bush suggested, compared more with Benito Mussolini or Adolf Hitler than Ho Chi Minh. Hussein's invasion of a weaker neighbor likewise compares more with the Nazi invasion of Czechoslovakia and Poland or the Italian invasion of Ethiopia in 1935 than any military action taken by the Vietminh, Viet Cong, or regular North Vietnamese Army (NVA) until after 1975. Indeed, Saddam Hussein was roundly condemned by a broad spectrum of nations and ideologies by even former allies, much as Hitler was in the late 1930s for his land grabs in Europe. In this case, unlike North Vietnam which received support from many parts of the world, Iraq was truly isolated.

Finally, in analyzing the Gulf War, one is struck by the fact that Iraqi tactics more closely resembled those employed in World War I by both sides or by the French at the Maginot Line in 1940, rather than NVA or Viet Cong insurgency tactics. The comparison goes even deeper when one examines the German's strategies of blitzkrieg and their right end run through the low countries in 1940 with General Schwarzkopf's "Hail Mary" student body left end run around the Iraqi forces in Southern Kuwait.³³

To understand both the Vietnam and Persian Gulf Wars, we must realize that the former was a guerrilla insurgency war for which the United States was not prepared, while the latter was a classic European style conventional war for which the US and its NATO allies had been preparing for over 45 years. American and allied strategies, tactics, training, operations plans, and military hardware were well suited for the Persian Gulf situation. The allies knew what to do and did it well. However, our leaders need to remember that not all future wars will necessarily be a repeat of the Persian Gulf. There are still potential Vietnam style

conflicts confronting the United States in places like Latin America, Africa, Asia, and the Pacific.

What Lessons Can Allied Air Power Learn From the Gulf War?

While it should be evident that Vietnam furnished little of *specific* military value to US and allied combat planners in the Persian Gulf, the American military policies developed after 1975 out of the aura of defeat, combined with basic common sense and professional expertise, led to a smashing American and allied victory in the Persian Gulf War. This was especially true with regard to air power. However, flush with victory as the members of US military aviation presently are, will its analysis of this War ask the right questions and create a viable policy for future victory? At this moment, when air power has finally proved its consummate worth, will leaders focus only on tactical and strategic bombing lessons overlooking other key needs like additional airlift capability, renewal of close ground support expertise, and the expansion of logistics and repair programs and facilities?

In the terminology of the day, the bottom line on military programs comes down to how much money Congress is willing to spend. At the present time, the Gulf War notwithstanding, that sum is shrinking. This is particularly critical for air power with its avionics and weapon systems, which are expensive by their very nature. Sophisticated planes and "smart bombs," like the ones everyone marveled at and cheered for on TV as they watched them destroy Iraqi installations and assure an allied victory, cost money. The research, development, production, and procurement of cutting edge technology are very expensive and so are maintenance, spares procurement, and pilot and ground crew training. Based on the results of the Gulf War, one case in point is the Patriot missile. It was in many ways the typical research and development (R&D) program which the media loved to criticize. Struggling with over-budget costs and lagging behind schedule because of unrealistic expectations and foolish accountability policies, this missile came close to being scrapped by Congressional cynics. However, its spectacular success in the Gulf War quickly and decisively ended all the legislative gripe sessions and led to additional funding for a next generation version of the missile system.

Ultimately, the public and the Congress must, in the aftermath of this War, take stock of how much they are willing to pay for victory overseas. Before American leaders can determine whether or not to punish future dictators like Manuel Noreiga or Saddam Hussein, the people and Congress must decide if the price is worth it. If they want future presidents to continue to project US will and national defense interests into the world, this country must have a strong military and that requires adequate funding for military appropriations. Americans must determine if the cost is worth it.

Based on the valuable contribution of the F-117A in the Gulf War, the continued development and testing of stealth technology is important. Indeed, bomber advocates are correct in their concern over America's lack of a new strategic (conventional or nuclear) bomber. This is true even with the decline of the military threat in Europe. The reconfirmation to the end of the Cold War by the failed Soviet coup of August 1991 and the formation of the Commonwealth of Independent Nations do not obviate the need for bombers in the Third World wars. This is particularly true in cases where strategic bombers could be used to attack urban and/or industrial centers such as those in and around Baghdad in the Gulf War.

In some ways the present situation is similar to that which existed prior to the Korean conflict. Congressional politics, fears by the Truman Administration and the Defense Department that Korea was a Soviet diversion for an attack in Europe, and uncertainty about the structural integrity of the B-36 left the US without a modern long-range bomber throughout the Korean War (1950-1953). The primary bomber used by UN forces throughout that war was the B-29 which, by that time, was considered a medium bomber. Although it did an admirable job, the B-36 was much more suited for the task in Korea, especially when confronting jet aircraft. The B-36 never did fly in combat.³⁴ Obviously, there are some differences too—the end of the former Soviet Union's Cold War posture being just one. But that does not lessen the need for at least a minimal fleet of new bombers to assume conventional roles in wars in places like Iraq.

Today, the B-52G "Stratofortresses," while replete with the latest avionics and high tech upgrades available, are still early 1950s aircraft.³⁵ To be sure, the B-52s did a great job carpet bombing Iraqi positions in Kuwait and Southern Iraq. All totaled, 48 US B-52s flew 1,624 missions and 1,595 combat sorties, expending 25,700 tons of ordnance over a 40-day period.³⁶ However, one TV commentator noted there probably is not an original bolt on any of the B-52s in the USAF inventory. The airframes are, in many cases, over 35 years old and the great old "BUFFs" need to be phased out and replaced by a more modern aircraft that can carry out both conventional and nuclear missions. Presently, only 70 of America's 260 B-52s are equipped for conventional bombing missions. The possibility of being caught again, as we were in Korea, certainly exists.³⁷

One possible solution is the continued development of the B-1B fleet (if its basic flaws can be worked out) and/or at least the limited production of the expensive B-2 Stealth bomber. In spite of their political, structural, and design problems, I think it is important to maintain both programs. The cost factor, especially in the case of the B-2, cannot be ignored in this era of DOD cutbacks and economic recession. However, potential world conflicts make it necessary for the US to produce at least some new bombers. After all, the early development programs of the Abrams tank and C-5 "Galaxy" were fraught with embarrassing malfunctions. And while neither development program was the kind contractors and/or the military would want to repeat, the value of the end product is hard to deny. Even the B-17, one of the most heavily used weapon systems in air power history, was considered dangerous, at the outset, because it crashed during its first official test flight at Wright Field in October 1935 due, as it turned out, to pilot error.³⁸ Obviously, the successful culmination of these strategic bomber programs would cost billions; but, if the Gulf War proved anything else, it was that no one aircraft can do every job. This means that American air power still needs strategic bombers even though the East-West confrontation of the Cold War era has eased in recent years.

Airlift

One such program is the construction of a fleet of new cargo/transport airlift aircraft to supplement and eventually replace the competent but aging C-130 "Hercules" and the C-141 "Starlifters." Although upgraded and stretched to accommodate modern needs for larger cargoes and aerial refueling, both are, like the B-52, aircraft from a past generation.³⁹

The first C-130s entered the Air Force inventory in the mid-1950s and the C-141A in January 1964. While both are still very serviceable and, due to their size and engines, more

adaptable than previous cargo/transport aircraft, they are between 25 and 35 years old. No thinking person wants to again be caught, like the US was in the early 1960s, with inadequate transport aircraft for its cargo airlift missions. While C-124s and their backups, C-119s, C-54s, and even C-47s were great old workhorses, they were, as General William Tunner argued in the late 1950s, never intended to carry out the large long distance cargo airlift missions that the Military Air Transport Service (later Military Airlift Command/MAC) were assigned during the Cold War era. The result was the belated construction of the C-141 Starlifter.⁴⁰

Both the C-130 and C-141 aircraft, like the B-52, because of modern modifications, still have some good years ahead. However, as the Desert Shield aspect of the Persian Gulf War proved, there is a need for more and better cargo and troop transport planes, such as the proposed C-17. Not that the airlift was not a great success; it performed magnificently. But, it was, by itself, inadequate to rapidly deploy the massive amounts of men and materiel needed in Saudi Arabia.

During Phase I (17 August - 31 December 1990), which was designed to provide defense for Saudi Arabia, the US flew 9,114 airlift sorties shipping 303,919 tons of supplies, 304,859 troops, and 400 tanks at a cost of nearly \$8 billion. The second Phase, which lasted from 1 January to 1 March 1991, was designed to provide the allies with offensive capabilities and resupply. It cost about another \$5.5 billion and brought the total airlift to 15,317 sorties, 519,458 tons, and 482,997 passengers. By 1 April 1991, C-5s, C-141s, converted KC-10s, and commercial charter aircraft had flown 17,331 strategic airlift missions. These were part of operations known as the "European Express"—daily flights from Rhein Main AB, Germany, to Dhahran, Saudi Arabia, and return and "Desert Express"—daily flights delivering critical mission capable (MICAP) or essential cargo to the areas of responsibility (AOR) via Charleston AFB, North Carolina; Torrejon AB, Spain; Dhahran, Saudi Arabia; Riyadh, Saudi Arabia; and return. Altogether it was, in seven months, the greatest American airlift in total numbers since the eight-year effort during the Vietnam conflict.⁴¹ While all the pertinent statistics are not available since the resupply will continue as long as US forces are in the Gulf area, they will undoubtedly show that the overall Desert Shield/Storm operations will be the largest such airlift both in total numbers and per capita in all military history.

Not only was the strategic airlift remarkable, but the in-theater distribution of vital cargo, mostly by C-130s, and the yeomen work of aerial refueling aircraft, like the KC-10 and KC-135, were also impressive. During Desert Shield intra-theater airlift moved 142,000 short tons of cargo and 134,000 passengers validating 3,500 airlift requests. During Desert Storm 13,000 missions were flown under "Camel" or cargo-only sorties and "Star" or passenger/cargo sorties. A total of 159,000 short tons and 184,000 passengers were deployed. This included 824 million gallons of jet fuel and 138.6 million pounds of ordnance during Desert Shield and 890 million gallons during Desert Storm. To store and issue this enormous amount of fuel, over 100 R-14 refuelers, 200 R-4 refuelers, an Air Transportable Hydrant Refueling System, and over 700 50,000-gallon fuel bladders were employed.

These fuel totals were augmented by the aerial distribution of fuel from 256 KC-135s and 46 KC-10s deployed to the region by the Strategic Air Command (SAC). During Desert Shield these aircraft flew 4,967 sorties, 19,089 hours, refueled 14,588 receivers (5,495 Navy/Marine), and off-loaded 68.2 million gallons of fuel. During Desert Storm they flew 15,434 sorties,

59,943 hours, refueled 45,955 receivers, and off-loaded 110.2 million gallons of fuel. Including non-combat missions, the KC-135 totals alone—from 7 August 1990 to 1 April 1991—came to 29,689 sorties, 68,531 receivers, and 905 million pounds of off-loaded fuel.⁴²

To quote General H. T. Johnson, Commander in Chief, US Transportation Command:

We moved more tons more miles in the first six weeks of Desert Shield than in 65 weeks of the Berlin Airlift.⁴³

In the end, this momentous effort was effectively carried out because of the innovation of airlift experts in the Air Force. To get the job done, some C-141s arrived in Saudi Arabia without their paint scheme. Several KC-10 (which have built-in cargo space) and KC-135R refuelers were temporarily converted into cargo haulers, and the Commercial Reserve Air Fleet (CRAF) was activated on 17 August 1990 to assure the rapid deployment of adequate men and supplies to the Gulf region. In addition, Air Force Logistics Command personnel created an "Air Force Logistics Information File (AFLIL), [to] track the status of materiel from the time it was ordered until it was received at destinations in theater. . . ."⁴⁴

The need for additional airlift aircraft, like the C-17s, which are more flexible (land on short runways, carry large/heavy loads, and deploy quickly to any part of the world), is critical to the future of US defense capabilities. The need for additional airlift capabilities brings to mind the old misspoken admonition often attributed to General Nathan Bedford Forrest, that "the essence of strategy was getting there furthest wuff the mostests."⁴⁵

Close Air Support: Tank Killers and Gunships

Another vital aspect of US air power demonstrated during the War is the close air support aircraft like the A-10 Thunderbolt II. Along with the PAVE SPECTRE, AC-130 gunship, and helicopter gunships like the Apache, the A-10 performed superbly in the Gulf War. Once the tactical fighters had interdicted the Iraqi air forces, the A-10s and the gunships, using the advantage of allied air superiority, devastated Iraqi tanks, artillery, and troops. By the end of the conflict, about 3,800 of the Iraqi's 4,200 tanks in the Kuwaiti Theatre were destroyed by allied forces. Of this number, 1,685 fell to coalition aircraft, two-thirds of these to gunships and tank killers. One of the fiercest battles of the ground campaign occurred in a valley north of Kuwait and about 25 miles south and west of Basra, Iraq, near the Euphrates River. In the engagement the gunships and tank killers flying in support of US ground forces and along with 400 Abrams tanks systematically chewed up 700 Iraqi tanks, over 200 other armored vehicles, and thousands of troops of the elite Hammurabi armored division of the Iraqi Republican Guard. So effective were the tank killers and gunships that US troops nicknamed the valley "the killing fields" or "the death zone." During General Schwarzkopf's now famous 27 February 1991 (the day of the battle) briefing, while discussing the number of tanks destroyed in the KTO, he declared:

As a matter of fact, that number [3000] is low because you can add 700 to that as a result of the battle that's going on right now with the Republican Guard.⁴⁶

By the day of the briefing, the allies had not only obliterated Iraqi armor but also captured over 50,000 Iraqi prisoners. This led Schwarzkopf to conclude:

There's not enough left at all for him [Hussein] to be a regional threat. . . . As you know, he has a very large army, but most of the army that is left north of the Tigris/Euphrates Valley is an infantry army, . . . which means it really isn't an offensive army. So it doesn't have enough left, unless someone chooses to rearm them in the future.⁴⁷

One other lesson learned from the Gulf War, and reinforced decisively by the close air experiences of the Vietnam War, was that tactical fighters, strategic bombers, and fighter-bombers cannot provide anything approaching the high level of close air support that gunships and attack aircraft can. Indeed, I think the reason the allies suffered only 200-300 casualties rather than the originally predicted 2,000-3,000 was, in large part, due to the success of the A-10s and her gunship counterparts as well as the skill of their pilots.⁴⁸

Yet, at one point in recent years, there were those in Washington who suggested that the A-10 should be phased out and that the Air Force abandon its role in close air support. Fortunately, such talk has faded for now. Hopefully, with the accomplishments of the tank killers in the Gulf War, such aircraft will be, in the future, upgraded and modified as the need arises. More such aircraft also need to be produced, perhaps the A-16 (attack version of the F-16) or the two seater A-10.⁴⁹

Logistics, Night Fighters, Environmental Missions, and Missiles

To be sure, the outstanding performance of the F-117A as night fighters and raiders, as well as that of Patriot missiles and the Air Force's "smart bombs," has received widespread public and Congressional attention. There is support to expand funding for these systems which performed such spectacular feats on primetime TV. The F-117A was so thoroughly effective in this role during the Gulf War that one would have to feel secure using the Stealth fighter equipped with the PAVE TACK laser targeting system well into the future. One official Air Force report declared, "The F117A with state-of-the-art stealth technology proved itself in combat with amazing success."⁵⁰

One of the most important missions, and one which will have some of the most long-lasting effects on the region, was the US bombing by F-111F fighter-bombers using laser-guided "smart" bombs on a Persian Gulf oil terminal on 27 January 1991. As promised, Saddam Hussein's forces initiated a massive oil leak in the Persian Gulf designed to destroy the environment. American planes destroyed and closed the outflow valves, not only saving Saudi Arabian desalinization plants and the Saudi water supply but also preventing an ecological disaster of generational proportions.⁵¹

All in all, throughout the examination of the Persian Gulf War, the most popularly overlooked aspect has been the vital nature of logistics and maintenance. This was particularly true with regard to the aircraft. This is not to say that those in the military did not appreciate the importance of logistics. From Generals Powell and Schwarzkopf to the supply sergeants at the front, those in the fight paid particular attention to their supplies and repair capabilities. General Schwarzkopf, in particular, left little to chance. His thorough attention to detail and his incorporation of all aspects of military preparation, including logistics, proved to be a key to the allied victory. As the General himself noted even before the War began, he had learned the lesson of how important good air support was as a Captain commanding South Vietnamese units in the field. He declared:

When I am the senior man on the ground . . . adequate air support is about 100 sorties of B-52s circling my head all in direct support of ME!⁵²

Obviously, his attention to air power from bombers to maintenance in the Persian Gulf began early in his career.

But, too many in the public and in Congress fail to understand the essential need for logistics and repairs and, thus, this could become a lost lesson. They often cannot understand the cost or critical nature of such things. Those in combat do! Today, this is a function which has become more and more complex and vital in the modern world of military strategy and tactics. As Lieutenant General Sir John Winthrop Hackett noted in his famous work, *The Profession of Arms*:

The primary function of an armed force is to fight in battle. This is nowadays impossible without a highly complex system of supporting activities, especially logistics.⁵³

Even Baron Henri De Jomini, one of the most influential military theorists of all time, recognized the significance of the logistics in his 1838 work, *The Art of War*. In one key passage he asserts that:

to be a good chief of staff, it [is] . . . necessary that a man should be acquainted with all the various branches of the art of war. If then the term logistics includes all this, . . . it would be nothing more nor less than the science of applying all possible military knowledge.⁵⁴

On the other hand, the public seldom appreciates or understands such things. After all, spare lug nuts, spark plugs, or cans of MREs are not as exciting as F-15s blowing up bridges, cruise missiles demolishing command centers, or tanks rolling over enemy trenches. Still, they are fundamental to military victory. The old axiom that an army fights on its stomach was never more vividly reaffirmed than in Kuwait. The image of starving Iraqis in tattered clothes, often without shoes, surrendering by the thousands, many times to newsmen, was indelibly etched in everyone's memories by television pictures from the battlefield. On the other side, no military has ever been better supplied. In the first month of Desert Shield alone, the Air Force airlifted \$2.5 million worth of Desert Battle Dress Uniforms (BDUs or "chocolate chips"), boots, socks, underwear, and Desert parkas to Saudi Arabia. From their helmets and gas masks to their water bottles and suntan oil from K-Mart, US and allied forces were the best equipped in history.⁵⁵

From the standpoint of the allied air forces, of equal significance has to be the air worthiness as well as structural integrity and mechanical reliability of its aircraft. The Air Force's Programmed Depot Maintenance, Field Depot Repair programs policies, and personnel all proved their worth in the Persian Gulf. As alluded to earlier, 2,790 allied aircraft (73% US) flew nearly 110,000 sorties in 6 weeks with the loss of only 51 planes (38 combat losses).⁵⁶ While overall statistics are still not open to the public, my belief is that less than half and maybe as few as half-a-dozen went down due to engine or mechanical malfunction or structural failure. In many cases, field repair teams, such as the Air Force's Combat Logistics Support Squadron (CLSS), had to repair AAA and other battle damage on the same aircraft two and three times a day for a force which averaged flying 3,000 sorties a day. Sometimes entire wings, rudders, tail sections, and landing gears had to be replaced. That was in addition to the constant repair and replacement of smaller engine parts and structural features like ailerons and spoilers. In addition, 437 engines were repaired or overhauled at large repair

and spares depots called "Queen Bee Depots" which were set up in strategic locations throughout Saudi Arabia.⁵⁷

The success of this effort is best exemplified by the fact that the MICAP rates throughout Desert Shield/Storm were maintained above 93% for all combat fighters assigned to USCENAF.⁵⁸ Considering many of these aircraft are between 20 and 30 years old, the reliability record in an environment of such prolonged and intense combat usage is remarkable. One can only hope that these less glamorous aspects of air power will receive as much attention in the future and be evaluated on an equal footing with the other important air power components.

Conclusion

In spite of all these positive lessons of success, one should realize, in retrospect, that Iraq, despite its impressive array of military hardware was, and is, a third world nation with a fifth rate economy.⁵⁹ Add to this equation the fact that throughout the 1980s most of Iraq's Gross National Product (GNP) was foolishly spent by Saddam Hussein on a draining war with Iran, the profitless creation of an internal arms industry, and the ill-fated development of a nuclear capability. All of this adventurism had left Iraq in dire economic straits even before the Gulf War.

One of the main reasons Iraq decided to invade Kuwait was to try to erase the \$15 billion debt she owed her neighbor. This was only part of a larger \$80 billion debt which she owed the rest of the world. On 23 January 1991, Secretary of Defense Richard Cheney revealed that Iraq had spent \$50 billion on armaments in the 1980s.⁶⁰ In the aftermath of the War, Iraq now has no economy at all!

An even greater catastrophe from the Iraqi military point of view was Saddam Hussein's total usurpation of military authority during the war. As General Schwarzkopf said:

As far as Saddam Hussein being a great military strategist, he is neither a strategist, nor is he schooled in the operational arts, nor is he a tactician, nor is he a general, nor is he a soldier. Other than that, he's a great military man. I want you to know that.⁶¹

Having said all this, let us not underestimate the achievements of the US military, in particular the role of air power, in this conflict. Neither should we ignore the outstanding leadership of our military officers and NCOs. If we learn nothing else from this War, their example of excellence should form a positive paradigm for future wartime leaders. No less an officer than General of the Army Douglas MacArthur once said:

More than most professions, the military is forced to depend on intelligent interpretation of the past for signposts charting the future. Devoid of opportunity, in peace, for self-instruction through actual practice in his profession, the soldier makes maximum use of historical record in assuring the readiness of himself and his command to function efficiently in emergency. The facts derived from historical analysis, he applies to conditions of the present and the proximate future, thus developing synthesis of appropriate method, organization, and doctrine.⁶²

To be sure, if we accept the General's thesis, the Gulf War has provided the professional military, as well as those who study such things, with a plethora of "lessons learned" and an entire pantheon of heroic examples.⁶³

Indeed, General McPeak's previously mentioned declaration, "that this was the first time in history that a field army has been defeated by air power," indicates the significance which Air Force leaders have placed on the lessons they have perceived

from the war.⁶⁴ The Gulf War air power victory also has provided experts with numerous lessons which, if grasped and studied properly, can lead to an even stronger American military—in this case air power. From this standpoint, while it emphatically reconfirmed the importance of air superiority and other obvious standard air power precepts, it also demonstrated the need to make a careful assessment of the allies' successful use of Electronic Warfare, the artful use of tactical and strategic aircraft to assure air superiority, proficient employment of the A-10s and gunships in close air support such as tank killers, proper logistics support, efficient airlift response, yeoman-like repair and maintenance efforts, and excellent night air combat capability. The list is endless and should also include examples of good war planning, tactical planning, and pre-war and in-theatre training and preparation.

From the standpoint of future policy, the results of the Gulf War also indicate that air power still needs various kinds of weapon systems, like the ones previously mentioned, to successfully undertake the myriad of missions it will face in the changing world of the post-Cold War era. In the future leaders must, like those in the Persian Gulf, pay attention to less glamorous details like logistics, field and depot repair, and airlift. On an official level General McPeak, during the conclusion of his 15 March 1991 briefing, poignantly charged future air power leaders to take to heart the need for "good leadership, a global approach for the Air Force, a single concept of operations, importance of air superiority, flexibility in the execution of air operations, contributions of stealth technology, the destructive power of precision guided weapons, and the importance of quality people and realistic training."⁶⁵

All in all, it is a cornucopia of events and phenomena for study by those air power analysts who make a living doing such things. In turn, it will be up to policymakers to determine which lessons are valuable and in what priority they should be placed for funding. Thus, the study of lessons learned in the Persian Gulf becomes even more critical in this era of defense austerity. In looking back at the Gulf War, one would hope these officials will examine all the precedents thoroughly, ask the proper questions, and provide the necessary answers to what the future of American air power will be in the 1990s and beyond. If the seeds from these lessons can be planted in fertile and open minds using the right kind of analysis and training, then the future germination of excellence and professionalization in the United States Armed Forces will be guaranteed.

Notes

¹Department of Defense News Briefing, by General Merrill A. "Tony" McPeak, Chief of Staff, United States Air Force, "The Air Campaign: Part of the Combined Arms Operations, 'The Mother of All Briefings,'" 15 March 1991 (hereafter cited as "Air Campaign"). Ron Martz, "With 1.8 Million Troops Facing Off, Here's How the War Could Begin," *The Atlanta Journal and Constitution*, 15 January 1991, p. A6; "America at War - The Background," *The Macon Telegraph and News*, 17 January 1991, p. 3A (hereafter cited as "America at War"); "Must This Mean War?" *Time*, Vol. 136, No. 9 (27 August 1990), pp. 14-16 (hereafter cited as "War").

²Beddown Report, by Dr Thomas Y'Blood, AF-HO, "USCENTAF Summary Report on Desert Shield/Desert Storm," 1 April 1991, pp. 1, 3 (hereafter cited as USCENTAF Report). According to this report, the U.S. build-up officially began on 5 August 1990 with the deployment of Lt Gen Charles A. Homer, Commander, USCENTAF. CENTCOM News Briefing, by General H. Norman Schwarzkopf, Commander, USCENTCOM, "Persian Gulf War," Riyadh, Saudi Arabia, 27 February 1991, p. 1 (hereafter cited as CENTCOM Briefing); McPeak, "Air Campaign," p. 2, Briefing Charts 1 and 2; "America at War"; "War," pp. 16-18.

³"America at War"; "War," pp. 17-21; "The Gulf War," *Time*, Vol. 137, No. 10 (11 March 1991), p. 32 (hereafter cited as "Gulf War"). For an analysis of the President's decision to go to war see Robert Woodward, *The Commanders* (New York: W. W. Norton, 1991) (hereafter cited as *Commanders*).

⁴"America at War"; "Gulf War," pp. 32-33; "The Gulf War" - Special Chart, *Time*, Vol. 137, No. 8 (foldout) (hereafter cited as Chart).

⁵"America at War"; "Gulf War," p. 33; Chart.

⁶"America at War"; "Gulf War," p. 33; Chart, pp. 41-42; "Congress Gives Bush War Powers," *Facts on File*, Vol. 51, No. 2617 (17 January 1991), p. 27.

⁷"America at War"; Chart.

⁸McPeak, "Air Campaign," Briefing Charts 3 and 4; USCENTAF Report, pp. 1, 3, 19; Chart.

⁹McPeak, "Air Campaign," pp. 2, 4; USCENTAF Report, p. 2; "Lead Attack of Jet Force 'awesome,'" *Macon Telegraph and News*, 17 January 1991, p. 4A.

¹⁰McPeak, "Air Campaign," p. 3, Briefing Charts 5 and 6.

¹¹Ibid., pp. 8-9, Briefing Chart 23; Briefing Transcript, by Pentagon Spokesperson, Peter Williams, 27 January 1991, section 1, p. 6. It should be noted that the difference in sortie numbers provided by different sources is that helicopter sorties were often not included. However, during the 28 February 1991 Theatre Briefing, the allied Spokesperson placed the official number of sorties at 110,000 for 43 days of combat. See *Facts on File*, Vol. 51, No. 2623 (28 February 1991), p. 129; *Washington Post*, 31 January 1991, in *Facts on File*, Vol. 51, No. 2619 (31 January 1991), p. 60. For details on the air war in Vietnam see Carl Berger ed., *The United States Air Force in Southeast Asia, 1961-1973: An Illustrated Account* (Washington, D.C.: Office of Air Force History, 1984) (hereafter cited as *USAF in SE Asia*); Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (New York: The Free Press, Inc., 1989) (hereafter cited as *Limits of Air Power*); Earl H. Tilford, Jr., *SetUp: What the Air Force Did in Vietnam and Why* (Maxwell AFB, Alabama: Air University Press, 1991) (hereafter cited as *SetUp*).

¹²Berger ed., *USAF in SE Asia*, pp. 95-99, 166-167; Clodfelter, *Limits of Air Power*, pp. 159-162, 184-191; Tilford, *SetUp*, pp. 228, 248-265, 284-297.

¹³McPeak, "Air Campaign," pp. 4, 5, 8, 11-12; USCENTAF Report, pp. 1, 3, 19, Chart 10; Lt Col Michael Perini, "Aircrews Launch in 'Desert Storm,'" *Airman* (February 1991), p. 9; Douglas Payne, "The War at a Glance," *The Atlanta Journal and Constitution*, 27 February 1991, p. A6 (hereafter cited as "Glance"). The 1900 U.S. aircraft in the Persian Gulf included: the Air Force's A-10 Thunderbolt IIs, B-52G Superfortresses, F-117A Stealth fighters, F-15C/D Eagles, F-16 C/D Falcons, F-15E Strike Eagles, F-4G Wild Weasels, E-3A Sentry, EF-111A/F-111F Ravens, E-8A Joint STARS, KC-10 refuelers, KC-135R refuelers, C-130 Hercules, C-141B Starlifters, AC-130 PAVE SPECTRE Gunships, and the Navy's A-6E Intruders, A-7 Corsair II, AV-8B Harriers, E-2C Hawkeyes, EA-6B Prowlers, F-14 Tomcats, and F-18 Hornets. For more on the performance of specific aircraft in the Gulf War see USCENTAF Report, p. 5 for the F-15E Strike Eagle equipped with Low Altitude Navigation Targeting Infrared System for Night (LANTIRN); pp. 5-6 for the F-117A; and White Paper, by HQ USAF, "Air Force Performance in Desert Storm," 1 April 1991, p. 5 for F-111s, F-16s, F-4Gs, and HARM missiles (hereafter cited as White Paper); Ibid., p. 3, 12 for F-117As, F-15Cs, Joint Surveillance Target and Attack Radar System (JSTARS), and AWACS; Briefing Transcript, General Charles C. McDonald, Commander, Air Force Logistics Command (AFLC) to Congressional Subcommittee on Readiness, Sustainability, and Support, "AFLC Participation in Operation Desert Storm," 2 May 1991, pp. 9-13 for the F-117A and p. 17 for the C-130 (hereafter cited as AFLC Briefing).

¹⁴McPeak, "Air Campaign," p. 13. This quote can also be found in Mark Clodfelter, "Of Demons, Storms, and Thunder: A Preliminary Look At Vietnam's Impact on The Persian Gulf Air Campaign," *Airpower Journal* (Winter 1991), p. 17 (hereafter cited as "Of Demons, Storms, and Thunder"). Major Clodfelter, in an effort to remain historically accurate, notes in his endnote number one that there are many examples in World Wars I and II where air forces defeated ground armies.

¹⁵See Note 13.

¹⁶McPeak, "Air Campaign," Briefing Chart 21; "Glance," p. A6; Briefing Transcript, by Pentagon Spokesperson, Peter Williams, 20 February 1991, section 1, p. 3; Ibid., Lt Gen Thomas Kelly, section 2, p. 4.

¹⁷Briefing Transcript by Pentagon Spokesperson, Lt Gen Thomas Kelly, 20 February 1991, section 4, p. 4.

¹⁸"Bush Addresses Congress, Vows Iraqi Defeat," *Facts on File*, Vol. 50, No. 2599 (14 September 1990), p. 671.

¹⁹McPeak, "Air Campaign," pp. 5-8, Briefing Charts 12, 15-21.

²⁰Ibid.; "Gulf War," p. 36.

²¹"Gulf War," p. 36.

²²Transcript, "Nationwide Television Broadcast of a speech by President George Bush on the beginning of the Air War in the Persian Gulf," 9:00 P.M. EST, 16 January 1991. This copy found in *Facts on File*, Vol. 51, No. 2617 (17 January 1991), p. 28 (hereafter cited as Bush Speech); "George Bush as Commander-in-Chief," *U.S. News and World Report*, Vol. 109, No. 26 (31 December 1990-7 January 1991), pp. 23-24.

²³Cloud, Stanley W., "Exorcising an Old Demon," *Time* (11 March 1991), p. 52.

²⁴"Lines in the Sand," *U.S. News and World Report*, Vol. 109, No. 13 (1 October 1990), pp. 29-34. Following along with this theme one of the most popular and compelling revisionist books written on Vietnam was by Admiral Ulysses Simpson Grant Sharp, entitled, *Strategy for Defeat: Vietnam in*

Retrospect (Novato, California: Presidio Press, 1986). The basic thesis blames U.S. defeat on U.S. political leaders with a lack of resolve. Sharp says, "We could have achieved victory with relative ease, and without using nuclear weapons or invading North Vietnam. All that we had to do to win was to use our existing air power - properly."

²⁵"You go in to Win Decisively," *U.S. News and World Report*, Vol. 109, No. 25 (24 December 1990), p. 26. For a poignant and revealing analysis of the U.S. political and military leaders during the Persian Gulf War see Woodward, *Commanders*.

²⁶Editorial - "Why Hussein Smells Victory," *U.S. News and World Report*, Vol. 109, No. 25 (24 December 1990), p. 67.

²⁷Clodfelter, "Of Demons, Storms, and Thunder," page 18.

²⁸For further examination of this issue see George Herring, *America's Longest War* (New York: John Wiley & Sons, Inc., 1979), pp. 130-131, 147-151 (hereafter cited as *Longest War*); Clodfelter, *Limits of Air Power*, pp. 137, 188-193; Berger ed., *USAF in SE Asia*, pp. 70-79, 166-167, 219-221. For those who read Herring and Clodfelter's books after reading Admiral Sharp's work they will clearly note that the two previously cited historians would disagree with the Admiral on the potentially decisive nature of air power in Vietnam. See Note 19.

²⁹Bush Speech.

³⁰For details on the PAVN and Viet Cong strategies, see Douglas Pike, *PAVN: People's Army of North Vietnam* (Novato, California: Presidio Press, 1986). Chapter one and the Conclusion express the above mentioned thesis very effectively (hereafter cited as *PAVN*). See also Douglas Pike, *Vietcong: The Organization and Techniques of the National Liberation Front of South Vietnam* (Cambridge, Massachusetts: M.I.T. Press, 1968) (hereafter cited as *Vietcong*).

³¹Karnow, Stanley, *Vietnam: A History* (New York: Viking Books, 1983), pp. 46-204; Herring, *America's Longest War* pp. 43-107; Pike, *PAVN*, see Chapters 2 and 3. These pages examine, through exhaustive primary research, the civil and colonial nature of the struggle and how U.S. entry tried to change it, but failed. This issue is also dealt with throughout Pike, *Vietcong*. Another more conservative work which generally agrees with the above mentioned notion is David Chanoff and Van Toai Doan, *Portrait of the Enemy* (New York: Random House, Inc., 1986).

³²For excellent and remarkably balanced accounts of problems experienced by South Vietnamese leaders and their problems with decision making due the U.S. presence see Bui Diem and David Chanoff, *In the Jaws of History* (Boston: Houghton-Mifflin, Inc., 1987).

³³CENTCOM Briefing, pp. 2-3; "Glance"; "Gulf War"; Anthony Kemp, *The Maginot Line, Myth and Reality* (New York: Military Heritage Press, 1988), pp. 84-92.

³⁴For details on the B-29 and B-36 during the Korean War, see Marcelle Size Knaack, *Encyclopedia of U.S. Air Force Aircraft and Missile Systems*, Vol. II, *Post-World War II Bombers, 1945-1973* (Washington, D.C.: Office of Air Force History, 1988), pp. 1-57, 479-494 (hereafter cited as *Post-WW II Bombers*). For details on the air war in Korea and the role of the B-29 see, Robert F. Futrell, *The United States Air Force in Korea, 1950-1953*, Revised Edition (Washington, D.C.: Office of Air Force History, 1983), pp. 25-32, 47-71, 91-102, 124-144, 151-167, 186-207, 220-226, 275-301, 314-318, 406-425, 442-452, 500-539, 583-605.

³⁵Knaack, *Post-WW II Bombers*, pp. 205-294. These pages cover the development of the B-52 models from the A model upon which R&D began in 1946 to the G and H models which were produced in the mid-60s and upgraded in the 1970s and again in the mid-1980s.

³⁶McPeak, "Air Campaign," pp. 11-12; USCENAF Report, pp. 16-17; White Paper, p. 5; AFLC Briefing, p. 21; Bill Sweetman, *Jane's Defense Weekly*, 1991, cited in "B-52 attack is awesome but how effective is it?" *The Atlanta Journal and Constitution*, 25 January 1991, p. A5 (hereafter cited as "B-52").

³⁷Sweetman, "B-52."

³⁸Walker, Lois and Wickam, Shelby. *From Huffman Prairie to the Moon: The History of Wright-Patterson Air Force Base* (Washington, D.C.: Government Printing Office, 1988), pp. 226-228.

³⁹For details on the C-141B Starlifter and its background see Walter L. Kraus, Jose M. Matheson, Joy Gustin, and Isobel M. Bryant, *C-141 Starlifter*. USAF Monograph (Scott AFB, Illinois: Military Airlift Command, Office of History, 1973); William Head, *Reworking the Workhorse: The C-141B Stretch Modification Program*, USAF Monograph (Robins AFB, Georgia: Warner Robins Air Logistics Center, Office of History, 1984).

⁴⁰For details of the U.S. airlift situation in the 1940s and 1950s see Lt General William H. Tunner, *Over the Hump*, Revised Edition (Washington, D.C.: Office of Air Force History, 1985), pp. 281-332. These pages detail Tunner's recommendations for the upgrade of Air Force airlift and his advice to President Kennedy to build the C-141.

⁴¹Message, U.S. Central Command to Military Airlift Command, Situation Report, "Desert Storm Airlift Figures," Feb 282134Z; MAC News Service, "CNC MAC Discusses the Past Year - Part I," *End of Year Report*, Dec 90

(hereafter cited as "CNC MAC"); USCENAF Report, p. 31, Chart 27, specifically these missions included: 4066 by C-5s, 8,904 by C-141s, 3,950 by KC-10s, and the rest by commercial charter. See also John Berry, "How Much is Enough," *Newsweek*, Vol. 66, No. 19 (5 November 1990), pp. 16-17; "Is Uncle Sam Being Suckered?" *Time*, Vol. 136, No. 27 (24 December 1990), p. 38; SMSgt Douglas I. Gilbert, "Logistics Lifeline: Sustaining Desert Shield," *Airman*, Vol. 34, No. 11 (November 1990), pp. 22-23.

⁴²USCENAF Report, pp. 2, 13, 19-26, 30-31, Chart 29, 31; AFLC Briefing, pp. 17, 21; White Paper, p. 9.

⁴³"CNC MAC."

⁴⁴See Notes 33 and 34. For three excellent articles discoursing the problems of massive airlift, the lessons of the past, and the solutions used in the Persian Gulf see Major Donald E. Hamblin, "Distribution Priority System: Time for a Change?" *Air Force Journal of Logistics*, Vol. 14, No. 4 (Fall 1990), pp. 17-21; Major Benjamin L. Dilla, "Logistics Support Limitations in the Vietnam War: Lessons for Today's Logisticians," *Ibid.*, pp. 35-38; SSgt James C. Mesco, "Airlifting Logistics: Warner Robins Air Logistics Center's Support of 'Desert Shield' Airlift Operations," *Air Force Journal of Logistics*, Vol. 15, No. 2 (Spring 1991), pp. 5-8.

⁴⁵Henry Steele Commager, ed., Lieutenant General Nathan Bedford Forrest of Tennessee, Cavalry Officer, Confederate States of America, 1821-1877, *The Civil War Almanac* (New York: American Heritage, Inc., 1983), p. 335. It should be noted that many historians do not believe that Forrest actually made the statement. No less an historian than Bruce Catton says in one of his numerous books on the Civil War that, "Not for nothing did Forrest say that the essence of strategy was 'to git thar fust with the most men.'" He goes on to warn, "Do not, under any circumstances whatever, quote Forrest as saying 'fustest' and 'mostest.' He did not say it that way, and nobody who knows anything about him imagines that he did." Bruce Catton, *The American Heritage Picture History of The Civil War*, Revised Edition (New York: American Heritage/Bonanza Books, 1982), p. 358.

⁴⁶McPeak, "Air Campaign," pp. 9-10, Briefing Chart 21; CENTCOM Briefing, pp. 6, 9; "Glance"; "Gulf War," p. 36; "U.S.-led Multinational force is largest since Korean War," *The Macon Telegraph and News*, 24 February 1991, p. 10A (hereafter cited as "Multinational force"); *Facts on File*, Vol. 51, No. 2623 (28 February 1991), p. 128.

⁴⁷CENTCOM Briefing, p. 7.

⁴⁸McPeak, "Air Campaign," pp. 5, 8, Briefing Chart 12. For information about Close Air Support and gunships in Vietnam see William Head, "AC-47 Gunship Development," *Air Power History*, Vol. 37, No. 3 (Fall 1990), pp. 37-46; Jack J. Ballard, *Development and Employment of Fixed Wing Gunships, 1962-1972: The United States Air Force in Southeast Asia* (Washington, D.C.: Office of Air Force History, 1982).

⁴⁹For more on F-16s being used as attack aircraft and how effective they were in the Gulf War using Maverick missiles see White Paper, p. 7.

⁵⁰*Ibid.*, p. 3; USCENAF Report, pp. 5-6; McPeak, "Air Campaign," pp. 4, 10, 12, Briefing Charts 4, 8, and 10; AFLC Briefing, pp. 9-13, these pages cover logistics support for the F-117A in the Gulf War.

⁵¹White Paper, p. 5; McPeak, "Air Campaign," p. 8; Andrew J. Glass and Ron Martz, "U.S. Attack Stems Oil Flow," *Atlanta Journal and Constitution*, 28 January 1991, p. A1.

⁵²"How the top cop in the Gulf sees his job," *U.S. News and World Report*, Vol. 109, No. 13 (1 October 1990), p. 35.

⁵³Head, William. *A Chronological History of the Warner Robins Air Logistics Center and Robins Air Force Base, Georgia, 1936-1986*, USAF Special Study (Robins AFB, Georgia: Warner Robins Air Logistics Center, Office of History, 1987), p. iii.

⁵⁴Rutenberg, Lt Col David C. and Allen, Jane S. *The Logistics of Waging War: American Logistics, 1774-1985, Emphasizing the Development of Airpower* (Gunter AFS, Alabama: Air Force Logistics Management Center, 1987), p. iv (hereafter cited as *The Logistics of Waging War*).

⁵⁵USCENAF Report, pp. 24-26.

⁵⁶McPeak, "Air Campaign," Briefing Chart 23; "Glance"; "Multinational force."

⁵⁷McPeak, "Air Campaign," p. 13; AFLC Briefing, p. 21; USCENAF Report, p. 4.

⁵⁸USCENAF Report, pp. 6-7.

⁵⁹*Military Technology The World Defence Almanac*, Vol. 88, No. 1 (January 1988), pp. 66, 247, 248.

⁶⁰*Facts on File*, Vol. 51, No. 2618 (24 January 1991), p. 44.

⁶¹CENTCOM Briefing, p. 10.

⁶²Rutenberg and Allen, *The Logistics of Waging War*, p. 1.

⁶³Nelan, Bruce W. "Revolution at Defense," Vol. 137, No. 11 (18 March 1991), pp. 25-26.

⁶⁴McPeak, "Air Campaign," p. 13.

⁶⁵*Ibid.*, Briefing Chart 25.

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MORALE LOGISTICS: Yesterday, Today, and Tomorrow

B. Lee Williams

Introduction

From the time the first Neanderthal man carried two war clubs, to today's concept of a National Aerospace Plane with three, four, five, or more redundant systems, logistics has played an ever-increasing role in survival. What sustains men in combat when the penalty for defeat is possible death? Is it professionalism, religion and ideology, freedom from anxiety, discipline, leadership, patriotism, or self-preservation—or a combination of all these—that constitutes high morale?

The mean time between failure (MTBF) for a fighting group is based upon Morale, Training, Bureaucracy, and Fighting. This article will briefly discuss these areas and then look in more detail at morale problems and the logistics associated with them.

Background

Morale

Morale, discipline, and esprit de corps, although not always close synonyms, are similar when they mean a condition or spirit which holds together a body of persons and reflects itself in the group's confidence, cheerfulness, and willingness to work toward a common goal—and during combat, the will to win.

Napoleon Bonaparte weighted morale three-to-one over material or physical factors. (1:35) General Patton equated slovenly personal appearance of troops as indicative of low morale, reportedly remarking, "If they don't look like soldiers they won't fight like soldiers!" (1:35) And, almost all commanders, if asked about their troops' morale, will say it is very, very high. But what is morale?

There is no definitive or even commonly agreed upon answer as to the meaning of morale. However, for the purpose of this article, we will consider morale to be the cheerfulness and willingness of a group of soldiers to serve their country in time of peace or war.

Training

The United States has always attempted and, since the American Revolution, succeeded in fielding the best-fed, best-trained, and best-equipped fighting force in the world. The effect of this on morale is tremendous. When soldiers have the best, they cannot help but feel they are the best and as such their cheerfulness and willingness to prove it increases.

This is much like the man who walked into a bar, got into a fight with another customer, pulled a knife, and was shot to death. After it was over, the man with the gun was heard to say, "Dumb guy, came to a gunfight armed with a knife."

One of the reasons for such high morale amongst the coalition troops in the Persian Gulf War was this feeling of being the best-fed, best-trained fighting force in the world. Also, they strongly believed they were going to a knife fight armed with the most advanced guns available.

Bureaucracy

In 1778, General Anthony Wayne requested 500 coats for his ill-clad men. The Clothier General, James Mease, a Congressional appointee, took a leave of absence and thus there was no one who could process the order. Upon Mease's return, he still refused to release the coats to Wayne because only yellow buttons were available and Pennsylvania's regimental design specified white buttons. Wayne's men continued to suffer and die from exposure until the specifications were changed. (2:15)

During the Korean War, US pilots would have to break off engagements with enemy aircraft because they crossed the Manchurian border, or in Vietnam we could not bomb or attack North Vietnamese troops and supplies in Cambodia or Laos. Fifty yards from the perimeter fence at Cam Ranh Bay was a Vietnamese monastery with seven assigned monks or priests. At almost any given time, we could count an excess of 20 monks. When you considered the whip antennas attached to the statue on top of the monastery, seven of the monks being above the age of about 60 and the rest under 30, and the constant sapper attacks in the area, one had to wonder why we allowed the monastery to continue operations, unhampered.

These, and many others, are examples of bureaucracy at work. Is troop morale lowered because of these bureaucratic actions or inactions? Have you ever played musical chairs where one player either never leaves his chair or else takes the chair with him?

Fighting

The type of fighting encountered during a war is a constant see-saw for morale; if the fighting is going good, morale is high and, if not, morale is low. At noon, 25 June 1876, General George Custer's regiment, the "matchless Seventh," in all probability had a fairly high level of morale; and it is safe to say that morale continued to go down throughout the day.

The tactics of "hit-and-run"; "harassment fire and bombing"; and, as in the Persian Gulf War, "24-hour bombing," are all designed to lower morale of the troops. Even the threat of chemical or biological warfare is highly detrimental to troop morale.

Logistics

General Logistics

The word *logistics* may stem from the French title of *major general des logis*, which translates in German to Quartiermeister, an officer whose duty was to lodge and camp the troops, to give direction to the marches of columns, and to locate them upon the ground. (2:iv) In fact, shortly after appointing George Washington as Commander-in-Chief of the Continental Army, Congress passed legislation in June 1775 authorizing the establishment of the staff office of Quartermaster General. This office was tasked to quarter, distribute marching orders, lay campsites, issue equipment, and transport troops. (2:6)

Somewhere, among all those dusty military history books, the original meaning of logistics has been lost. Today, logistics can mean just about anything, to just about anyone, depending upon his or her particular job, skill, or involvement.

The Department of Defense defines logistics as:

The functional fields of military operations concerned with: (1) material requirements; (2) production planning and scheduling; (3) acquisition, inventory management, storage, maintenance, distribution and disposal of material, supplies, tools, and equipment; (4) transportation, telecommunications, petroleum, and other logistical services; (5) supply cataloging, standardization, and quality control; (6) commercial and industrial activities and facilities including industrial equipment; and (7) vulnerability of resources to attack damage. (3:1-1)

Military Logistics and Combat Logistics

If we add to this:

(1) design, development, acquisition, and maintenance of weapon systems; (2) movement, evacuation, and hospitalization of personnel; (3) feeding, housing, training, supervising, and sustaining of troops; and (4) recruitment,

we now have the definition of military logistics. We should note the only difference between the definition of logistics, which can be used for any business or corporation, and military logistics is the design and procurement of weapon systems and the provisioning of troops. Most businesses or corporations do not become too involved in either of these two areas.

Is this definition of military logistics all encompassing? No, probably not. But it is sufficient to show the magnitude of the logistics arena. Is military logistics efficient? Yes, during peacetime. But, in case of war, "military logistics" becomes "combat logistics," and it is no longer adequate to be merely efficient; logistics must also be highly effective. When involved in peacetime with military logistics, we must be concerned with the political and economical ramifications of our actions; but in wartime, political policies change and the measure of economy changes from dollars to lives. (4:4)

Morale Logistics

The term "morale logistics," as far as this author has found, was first used by Jerome G. Peppers, Jr., C.P.L., in his book *Military Logistics: A History of United States Military Logistics, 1935-1985*, to draw attention to those items of a logistics nature necessary for the support of troop morale. (5:197) In other words, the term meant those factors of a logistics nature which influence the cheerfulness and willingness of a group of soldiers to serve their country.

Morale and Morale Logistics

History

Drink, at one time, was the most common form of morale booster. It is believed that, in battles such as Agincourt, there was drinking in the ranks on both sides of the battle; and, in all probability, many soldiers were less than sober during battle. (6:113) The English relied heavily on the daily ration of rum or ale to bolster the morale of their soldiers and in fact often withheld it as a form of punishment or gave an extra tot as praise.

Rape, pillage, and plunder were powerful incentives in Medieval days to join the ranks of soldiers. For some soldiers just the chance at battle was sufficient cause to join the army, while still others found it an alternative to prison.

Religion often found its place as an inducement in the early Crusades and Holy Wars, as well as in many wars and battles since then. And of course to rally around the colours, flags, pennants, etc., has always been common.

What is common in all these examples is the service had to offer the soldiers something for their involvement, and it had to be something they wanted and for which they were willing to risk their lives. In other words, the service had to offer some form of motivation and they had to accept. Motivation can be defined as that internal force which activates, provides direction to, and determines the persistence of individual behavior—what soldiers will do and how long they will continue to do it. Satisfaction refers to soldiers' attitudes or feelings toward their assignments—how they feel about doing what they are ordered to do. (1:35-36)

Regardless of how motivated the soldiers are, to do their job they have to also be satisfied. Satisfaction deals with all aspects of their lives, including pay, living conditions, recreational opportunities, leave, and a myriad of other things. These inducements add up to morale in their minds and their cheerfulness and willingness to serve.

Today, in the era of an all-volunteer service, this is even more important and it can take many forms: patriotism, salary, education, retirement, medical benefits, etc. The average American soldier in Saudi Arabia was a husband or wife, had children, and ate dinner at home. (7:2) Morale is seldom a problem during peacetime, because soldiers are in essence only soldiers during duty hours and civilians after that. They reap the benefits for which they originally enlisted and often go home to their families each day after work. Unlike the days of the Crusades, modern soldiers do not expect to be called upon to fight a war; the possibility of war exists, but is often discounted by the soldiers. Morale does become a problem during wartime and extra logistical attention must be paid to maintain high troop morale.

Factors Influencing Troop Morale

There are literally hundreds of items which can and do influence troop morale. These items can range from the everyday problems of clean socks to long-term political issues, from lack of junk food to religious principles, from shower facilities to operating theaters, and from pure boredom to overworked conditions. For the purpose of this article, we shall look at two areas of morale factors that have always been of main concern to troops in combat—mail and food. It is interesting to note that at least since World War II, and probably much earlier than that, mail delays and food quality have been the two areas of largest complaint in morale logistics.

Mail and Food

Yesterday

Mail

"In garrison and in the field, officers must fight continually to secure prompt deliverance of mail. No other factor in a soldier's existence is so important as the prompt receipt of news from home." (8:1) This is part of an extract from an article on morale written for junior officers of the Coast Artillery Corps in 1943, and it is just as appropriate today as it was in 1943.

From a purely logistical point of view, we understand why we should strive to get the "beans, bullets, and bandages" to a combat area as soon as possible and set a lower priority to mail

delivery. However, from the point of view of the soldiers, mail was news from home and above all else they needed this news and support. In World War II, especially, this mail from home was often their only source of information about the war other than their own troop actions.

Mail is heavy and bulky to deliver. Therefore, during World War II, "V-Mail" was established to cut down on the amount of space and weight required for mail transport. A white form (8 1/2 by 11 inches) with writing borders was provided to anyone desiring to send letters overseas. The sender would write his or her letter on this form, staying within the borders, and fold, seal, and mail it. The letter was then microfilmed and sent overseas. One reel of 100 feet of 16-mm film could contain about 1500 or more letters and weighed only about 6 ounces needing only 16 cubic inches of transport space. Once in-country, the film was reproduced onto paper measuring about 4 by 5 inches and delivered to the addressee. (3:2-20) (5:91)

V-Mail was extremely popular because it allowed the mail to go through more quickly. In fact, millions of V-Mail letters were ultimately processed with the highest volume being in April 1944 when 64 million letters were received. The Army postal system alone in fiscal year 1944 handled 3,611,920,000 letters. (5:91) Little has been written about the mail service in Korea and Vietnam except to say the mail was still the number one priority of the troops. V-Mail has not been used for overseas letters since World War II, but the U.S. Postal Service continued to allow the word "FREE" to be written on letters by servicemen in combat areas in lieu of stamps.



Personnel loading mail on helicopter during Korean War.

Also, in the Vietnam War, mail order became very popular. Even though Vietnam has sometimes been called the "air-conditioned war," many items were not available in-country. The Air Force, Army, and Navy exchange systems each had its own mail order catalogs. An individual could also find, in about every barracks, copies of popular catalogs such as *Sears and Roebuck*, *Montgomery Ward*, *J.C. Whitney*, and *Frederick's of Hollywood*.

These mail order catalogs were not only used as "wish books," but were in fact used to order a wide range of items such as mini-refrigerators, stereos, lounge chairs, food items, and of course movies and pornographic material. Mail order was also a way to send gifts home to loved ones or for personal use after

the soldiers' return to the land of the "Big PX." All these items were allowed to be purchased tax-free.

Food

Since before the days of the Roman Empire, feeding the troops has been a major problem. Often, troops were expected to live off the land and beg, borrow, or steal what they needed to feed themselves and their animals. As more and more emphasis was placed on logistics, the services began to support the troops to a higher degree or at least to supply them with some form of edible substance. This reliance on logistics was especially pronounced after the legislative authorization of the Commissary General of Stores and Supplies for the Continental Army in June 1775. The Commissary General, like the Quartermaster General, reported directly to Congress and was responsible for feeding the troops. (3:6)

This substance took the form of hard tack and beef stew during the Spanish-American War and progressed to corned beef, baked beans, canned vegetables, and bread during World War I. By World War II, the services were eating boneless beef, dried eggs, canned vegetables, bread, and a new, much belittled product which gave the theater its nickname—"Spamland."

By the time of the 1944 Normandy invasion, US services were being provided with five major types of combat rations: C-rations, K-rations, D-rations, 5-in-1s, and 10-in-1s. However, regardless of the amount and type of food provided, food was the number one gripe of servicemen and women in World War II. The difficulty involved in providing six to seven pounds of rations per day, to 12 million personnel, at hundreds of locations worldwide, was phenomenal. (5:124-127)

Potable water was also another area of discontent among the troops. In areas outside the United States, water was often mineralized, or otherwise different from the taste the soldiers were used to. Often, the water was treated for purity and ended with a medicinal taste, as well as an additional flavor from the storage containers—canvas bags, mobile tanks, and even converted oiler ships. At the onset of the Korean War, most of the troops lived off surplus World War II rations; but, once the war stabilized, food service became quite adequate. Due to the limited combat area, troops were often fed two hot meals (breakfast and dinner) per day in forward combat areas, with lunch being left to combat rations. (5:193)

Vietnam again held claim to its nickname of the "air-conditioned war" by serving food unlike any other war in US history—with the use of large numbers of refrigerators, refrigerated trucks or vans, and helicopters for forward distribution of hot meals. In fact, three recombining milk plants were constructed in the Republic of Vietnam for United States forces, and fresh milk and ice cream were normal even on the front lines. (5:270) In fact, the two most common complaints by servicemen were the high mineral content of the water and a formaldehyde taste to the beer!

Today

Mail

"Mail call: 'Lost hope in desert'" reads a 1991 newspaper headline talking about mail call to Operation Desert Storm. (9:1) Another reported, "U.S. troops say the war effort is rolling right along—it's the mail that's bogged down." (9:1) Yet, according to newspaper accounts, upwards of 700 tons of mail were being delivered to Saudi Arabia per day. (10:1) It seems getting the mail to Saudi Arabia was not the problem; getting the mail to the

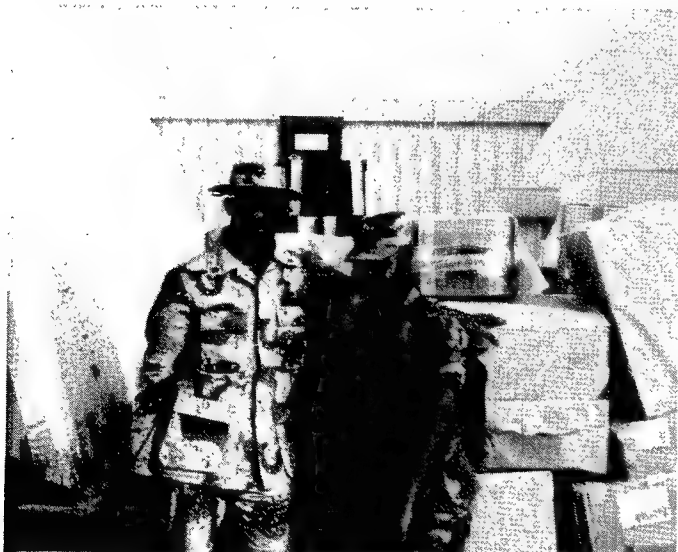
troops due to lack of trucks was the real problem. Regardless of the problem, the Persian Gulf War was no different than any other war in that mail delays were near the top of the list of G.I. complaints.

Of special treat to the soldiers was the mail arriving marked "Any Serviceman." Approximately 40% of the mail delivered in-country was marked this way and was to be distributed to any serviceman who wanted a letter. Most of these letters came from people in the United States just trying to show their support to the troops. Letters were from concerned citizens, school children, and even spinsters looking for marriage. To the serviceman, it did not matter...it was a letter! The troops thoroughly enjoyed these letters because they provided news from home, showed people back home cared for them, and gave them an opportunity to write back, breaking up the daily boredom.

The audio cassette tapes were again being used to send and receive mail, much like they were in Vietnam. However, unlike Vietnam, amateur radio operators were patching through hundreds of calls daily from Saudi Arabia to homes in the United States. Also, many organizations and businesses were offering free FAX transmission or computerized letter service to Saudi Arabia and eventually had return service.

A new era of mail started with the Persian Gulf War and the use of VCRs. Corporate sponsors such as Sony, RCA, and Toshiba donated VCRs and camcorders to the servicemen stationed in Saudi Arabia, enabling them to video tape letters home and to play back letters received.

Lieutenant Colonel Fred Nichols, Deputy Commander of the organization which handled Army mail, stated: "It was really the only contact we had with our families. From the generals on down to the lowest private, mail is the lifeblood of the morale system." (11:1) Or, to sum up the troops' feelings towards mail, Specialist Judith Huffman, of Fort Sam Houston, Texas, said it quite well, "If the troops didn't have their mail, they'd go bonkers." (11:1)



SPC Sherwood Baldwin and Sgt Ella White take a break from work. The boxes in the rear contain mail that just arrived from the States to be shipped to the troops on the front line.

Food

A popular Army maxim is that a bitching soldier is a happy soldier; and, in that case, we once again had some happy soldiers

in the Persian Gulf when it came to food. Common complaints were "warm bottled water and no bottled beer." (12:1)

Whenever we take packages of food and preserve them sufficiently in order to measure their shelf life in years, we are going to have complaints. During the war, with the issuance of Meals-Ready-to-Eat (MREs), in 14 assorted flavors, we now had 14 reasons to complain. MRE #5, featuring spaghetti and tomato sauce, was among the most popular; but the MRE containing a ham omelet was supposedly refused by all but the most ravenous. The MRE containing chicken-a-la-king gained new stature after the addition of M&Ms in the accessory kit. The preferred dessert was either the chocolate nut cake or the oatmeal bars. The accessory kit was always enjoyed and contained toilet paper, matches, chewing gum (supposedly the only edible portion), sugar packets, and a substance advertised as instant coffee. (12:1)

Even though the MREs were as the name implies, ready to eat, most soldiers did attempt to heat them. This heating was done by setting the MRE in the sun, placing it on a vehicle engine, or using ovens provided to each company. But even then, according to the soldiers, "The items were tough as granite and widely considered suitable ammunition should it come down to hand-to-hand combat with the Iraqis." Another ploy by the soldiers was to cover the meal with hot sauce so they could at least say they had a hot meal. (12:1)

The mess hall was even worse than the dehydrated meals claimed some of the soldiers. They were supposedly served rice and meat, usually camel, everyday. And for lunch, they received what they affectionately called "bag nasties"—two sandwiches, made with the ever popular camel or some other mystery meat, an orange, an apple, and a pop. They said the sandwiches usually wound up in the trash bin. (13:1)

Tomorrow

Mail

We usually assume that we will have problems with mail delivery during wartime because the "beans and bullets" must be delivered before mail. Troops are constantly redeploying and thus are hard to track down for mail purposes, the postal system is inundated with mail, and a letter which normally takes three weeks for delivery seems like forever when that is all a soldier has to look forward to in an otherwise overstressed but boring day.

Several changes could be made to possibly alleviate some of the problems; but short of overnight delivery, which would only be to a staging area with no guarantee of when mail would be forwarded, people are still going to complain. One alternative would be the issuance of lightweight, prefolded, single sheets of writing paper issued with MREs (if we can issue a condom with the MREs, why not stationery?), and people writing to servicemen could be instructed to use the same for delivery. This would drastically cut the weight and bulkiness of mail delivery. Possibly, we could even look into a system like V-Mail (World War II) for use at least during the initial phases of deployment.

Another alternative would be FAXing letters to the combat zone for delivery forwarding or the optical scanning of typed letters and data transmission of same. Computer generated or written letters, consolidated in the States, could either be delivered in-country by magnetic tape media or transmitted electronically for printout in the combat zone.

Almost as important to the soldier as knowing his family is all right is news of the war, national developments, and local area news. Perhaps more emphasis could be placed on newspapers.

Papers such as *USA Today* are initially set up for data transmission and could easily be partially reprinted in-country. As part of the war effort at home, magazine and newspaper companies could send copies of their publications in-country for distribution...talk about a captured audience.

Food

Short of having mobile McDonald's and Pizza Hut delivery service, there are going to be complaints. The old maxim that "an Army travels on its stomach" is no less true today than in the days of Alexander the Great.

One logistics article on World War II combat rations stated, "Compact, portable, instantly usable without elaborate preparation or cooking, these rations were a triumph of 'low' technology." (2:124) Two items were worthy of note: no mention was made of taste and it was a triumph of "low" technology. Perhaps it is time we tried a "high" technology approach. True, with the advent of MREs, we have reached a higher level of technology than with the old World War II C-rations; but until they are edible, there will be complaints.

This author, being single and a connoisseur of TV dinners, finds it hard to believe that with the combined talents of Swanson, Betty Crocker, Campbells, Kraft, French's, Pillsbury, etc., we cannot come up with an edible packaged dinner. Perhaps we should investigate these companies producing extra meals (not requiring microwave ovens) during wartime for delivery to our troops.

Another alternative would be to feed our troops Warsaw Pact combat rations for the first few days and then switch to MREs. The U.S.S.R combat rations for the general armed forces consisted of one can of meat, two cans of a cereal product called *kasha* (a porridge mixture made from buckwheat, rice, peas, or macaroni, to which is added onions, carrots, salt, pepper, fat, and occasionally meat), sugar, tea, and crackers. (14:16) East Germany provides its troops with canned meat, hardtack, marmalade, instant tea, vitamin C-fortified hard candy, and salt. And Poland supplies its troops with 100 grams of canned meat, 10 crackers or packaged dry bread, powdered milk and coffee, and sugar or chocolate. MREs aren't too bad!

Other Morale Factors We Must Consider

Although we have only talked about mail and food as morale builders in this article, many other items can influence troop morale during combat. Homefront support, or lack of support, was very predominant during Vietnam as a morale buster. Access to state-of-the-art weapons was a definite morale boon during the Persian Gulf War as well as support to the families at home. The availability of prompt medical services and their adequacy are of constant concern to combat troops and the fact that medical facilities and care continue to improve is again a morale builder. Clothing, movies, radio, television, and video cassette recorders all play vital roles in improving or degrading morale. We could go on and on, but needless to say that anything considered important to the troops, should be twice as important to us as logisticians...three times as important according to Napoleon Bonaparte.

Conclusion

Morale logistics is an important part of all military logistics, but is of paramount importance during times of combat. Military personnel are required to perform duties during combat which may not only be done under the most arduous of conditions, but also at the risk of their lives.

We have looked at morale as being the cheerfulness and willingness of a group of soldiers to serve their country in time of peace or war. We have looked at morale logistics as that part of military logistics or combat logistics necessary for the support of troop morale. And, we have looked at a few of the many factors which can either inflate or deflate this morale.

Although many things have changed since the early days of combat, two things are still lacking as far as the soldier is concerned: mail delivery and food quality. While it is understandable why ammunition, guns, and other supplies have precedence over mail at the beginning of a conflict, it is not understandable why the mail should continue to be delayed after the theater is fairly well established. Perhaps the same specifications should be put on mail as on the combat rations; mail, like combat rations, must have a shelf life of five years. It is also fairly safe to say morale is definitely boosted because of the specifications controlling how MREs are to be manufactured. What more could a soldier want, than to know that according to MIL-SPEC, the ingredients in his hot dog "shall be clean, sound, wholesome, and free from foreign materials, evidence of rodent or insect infestation, extraneous material, off-odors, off-flavors, and off-colors." (15:4) Yum-Yum! Is it any wonder that MREs were known in Saudi Arabia as "Meals-Rejected by Ethiopians."

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Best Available Copy

The Airlift Clearance Authority: Providing Shipper Services at the Aerial Port

Captain Gary W. Larberg, USAF

Located in the middle of the aerial port complex at Rhein Main Air Base, Germany, is Detachment 2, 7317th Materiel Flight, a small United States Air Forces Europe (USAFE) special transportation activity. More commonly known as the Airlift Clearance Authority (ACA), this group of transportation specialists is working in concert with European theater shippers and transportation agencies to move cargo into the military airlift system. Often mistaken as a Military Airlift Command (MAC) function, Detachment 2 is clearly a USAFE unit with a distinct mission of its own.

Background

Detachment 2 is one of five regional ACAs established in 1972 in response to a need for a consolidated, multiservice function that could ensure the orderly flow of all Department of Defense (DOD) sponsored cargo into the airlift system. ACAs provide interface between USAFE and U.S. Army Europe (USAREUR) traffic management offices, as well as US and foreign contractors and the MAC airlift system. Virtually any activity that prepares, documents, and delivers cargo to the MAC

aerial port for regular channel airlift must clear their arrival with the regional ACA.

ACAs are assigned as direct representatives of the United States European Command (USEUCOM) through Headquarters USAFE and the Numbered Air Forces. ACA detachments are located at Rhein Main and Ramstein Air Bases in Germany; RAF Mildenhall, United Kingdom; Torrejon AB, Spain; and Incirlik AB, Turkey (Figure 1).

Role of the ACA in Peacetime

The ACA is primarily concerned with the efficient movement of cargo into the airlift system. Its mission is to control the flow of originating export cargo into the aerial port, ensuring shipments are properly packaged, labeled, documented, and otherwise eligible for MAC channel airlift. The goal is to keep the cargo moving into the port while careful not to over- or underutilize the port's capacity to process, park, and airlift the cargo. At Rhein Main, this requires close coordination between the ACA, the Army's Air Terminal Movement Control Team (ATMCT), the aerial port squadron, and USAFE and USAREUR transportation offices. It is essentially a

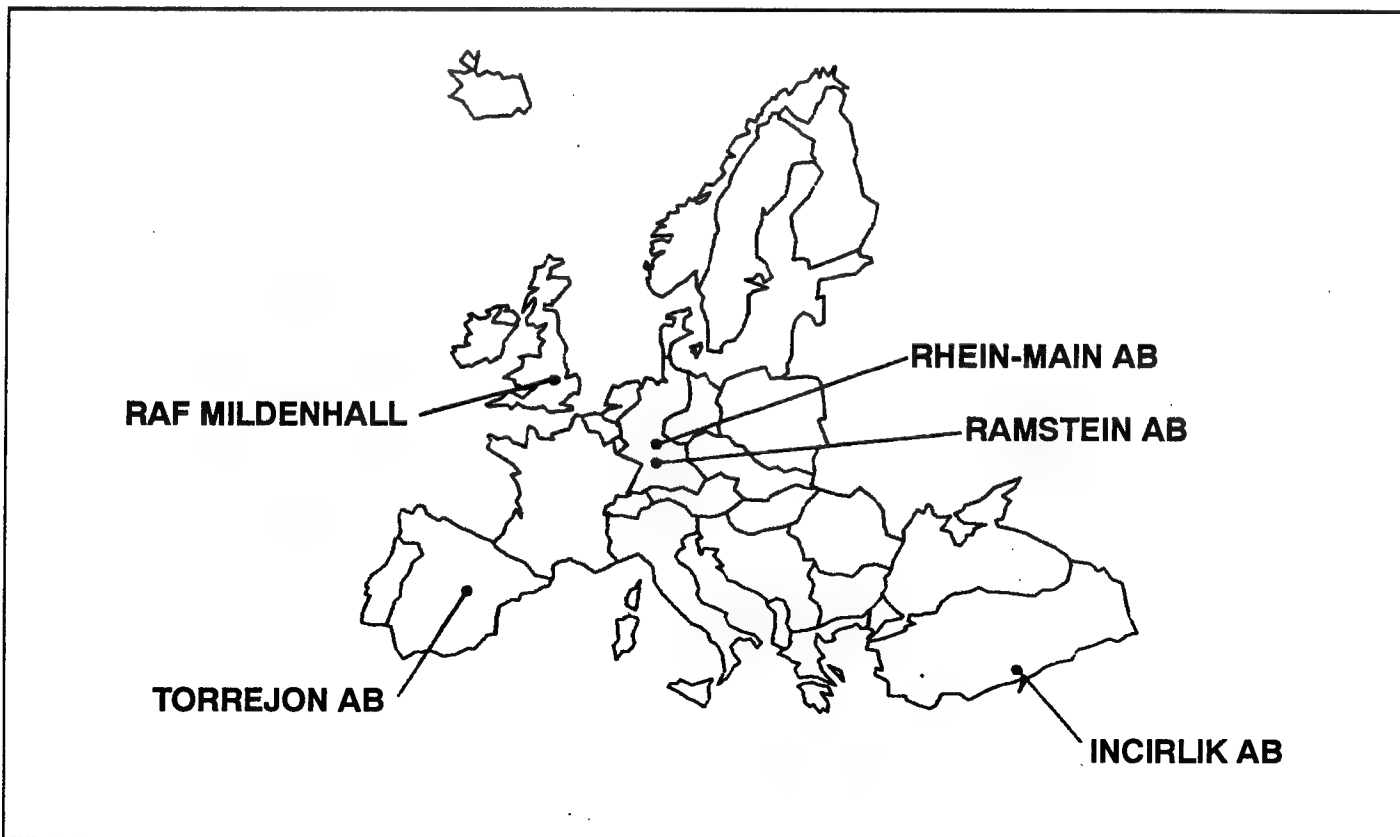


Figure 1. Regional ACA Sites.

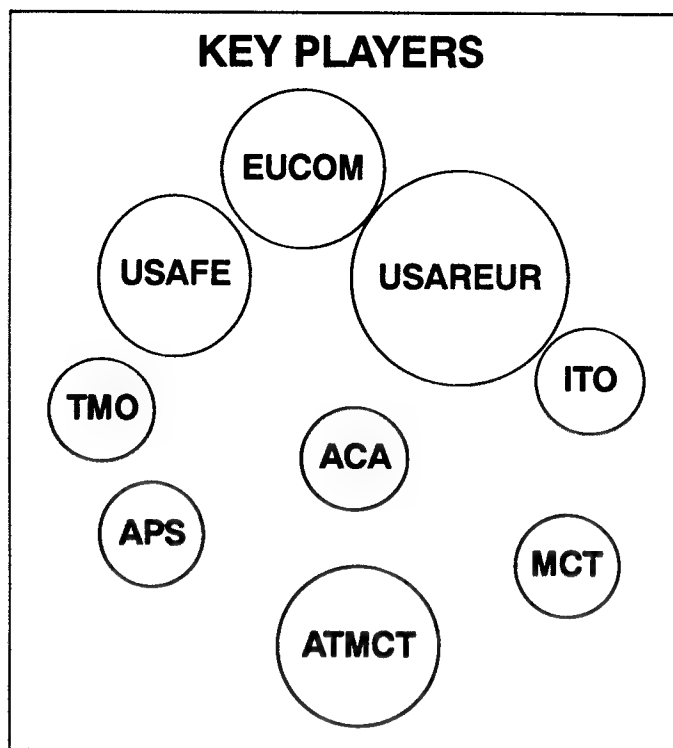


Figure 2. Communication and coordination between the key players helps facilitate the movement of cargo into the airlift system.

coordination, communication, and cooperation challenge (Figure 2).

In addition to controlling the flow of originating cargo, the ACA expedites onward movement of high priority shipments, monitors intratheater cargo movement, troubleshoots frustrated shipments, and provides tracer action on lost or delayed shipments. The workload and volume of cargo vary, but the ACA is manned to carry out these tasks under normal peacetime conditions.

Controlling Cargo Flow

Cargo Clearance Process

The ACA clears all cargo entering the airlift system, except cargo moving on special assignment airlift missions (SAAMs). On a daily basis, the ACA receives advance notification of shipments being prepared for airlift at the unit/depot level within the theater. The shipper's transportation office prepares the Advance Transportation Control & Movement Documents (ATCMDs) and transmits them to the ACA via telex or FAX. ATCMDs are required at least 24 hours prior to the requested port delivery date and serve as a request for airlift clearance. This allows the ACA time to review the documentation, make corrections, and coordinate with the MAC personnel to ensure storage can be arranged, especially for any hazardous cargo that cannot be mixed.

Air Force Traffic Management Offices (TMOs) send their ATCMDs directly to the ACA for clearance. However, Army Installation Transportation Offices (ITOs) in Germany submit their requests for air export clearance through a servicing Movement Control Team (MCT) who validates the request and forwards it to the Army's ATMCT at either Rhein Main or Ramstein. The ATMCT coordinates directly with the ACA on behalf of the army shippers to receive clearance dates and any

special instructions. The ATMCT is the focal point for resolving problems associated with incoming army sponsored cargo.

Normally cargo is cleared for the requested date, providing there are no discrepancies with the documentation and the port has the capacity to handle it. However, since commodities of cargo such as Household Goods move on a space-available basis, they are assigned specific clearance and arrival dates in order to time their movement based on the availability of airlift.

The ACA quality checks the ATCMDs and inputs them into the Consolidated Aerial Port Subsystem (CAPS) computer. The CAPS system enables the transporters to process and track the shipment as it moves in the airlift system. The ACA monitors the tonnage projected for each day and provides this forecast to the aerial port daily.

Clearance Factors

Airlift clearance is based on available airlift, air terminal cargo backlogs, compatibility and/or storage, and forecasted requirements. Arrival times are coordinated to avoid traffic jams and capacity problems at the Export Freight and Special Handling sections. If cargo movement slows up, the ACA works with the port to control the backlog, which affects the ability to bring in additional cargo. The ACA is working in the shipper's behalf, but must first coordinate port capabilities based on available airlift, storage, and forecasted requirements (Figure 3).

Expediting Cargo

Generally, cargo moves on a "first in-first out" basis. Old age cargo has priority and is loadplanned first. However, sometimes an operational field commander's immediate need for a shipment of high priority "mission critical" equipment will require moving a shipment out of sequence. When this occurs, the ACA works with the requester to validate the requirement and then notifies the MAC loadplanners so they can pull the cargo according to the priority. This action is commonly known as "greensheeting" and is used only in exceptional cases.

Honest Brokers

As USEUCOM's representative at the port, the ACA works as the "honest broker" between the Army, Air Force, and other DOD shippers to validate greensheet requests. The ACA coordinates directly with EUCOM's Joint Movements Control Organization (JMCO) to resolve movement priority issues requiring adjudication. This keeps MAC from having to field calls from shippers and allows them instead to concentrate on cargo processing and airlift.

Frustrated Shipments

If originating export cargo is improperly prepared for airlift, or if intransit cargo becomes damaged in the airlift system, it may be "frustrated" until the discrepancies are fixed. The ACA keeps track of all frustrated cargo and coordinates with the appropriate base agencies to get the shipments ready for airlift. It is also the ACA's responsibility to conduct aggressive follow-up to keep the shipments moving.

Tracer Actions

The ACA receives many requests for tracer actions on cargo and personal property shipments working their way through the airlift system. If a shipment has been delayed or is past its delivery date, the ACA will check the shipment status using the CAPS computer. If the shipment has been processed, palletized, loadplanned, or airlifted, the ACA can provide that status.

CARGO CLEARANCE PROCESS

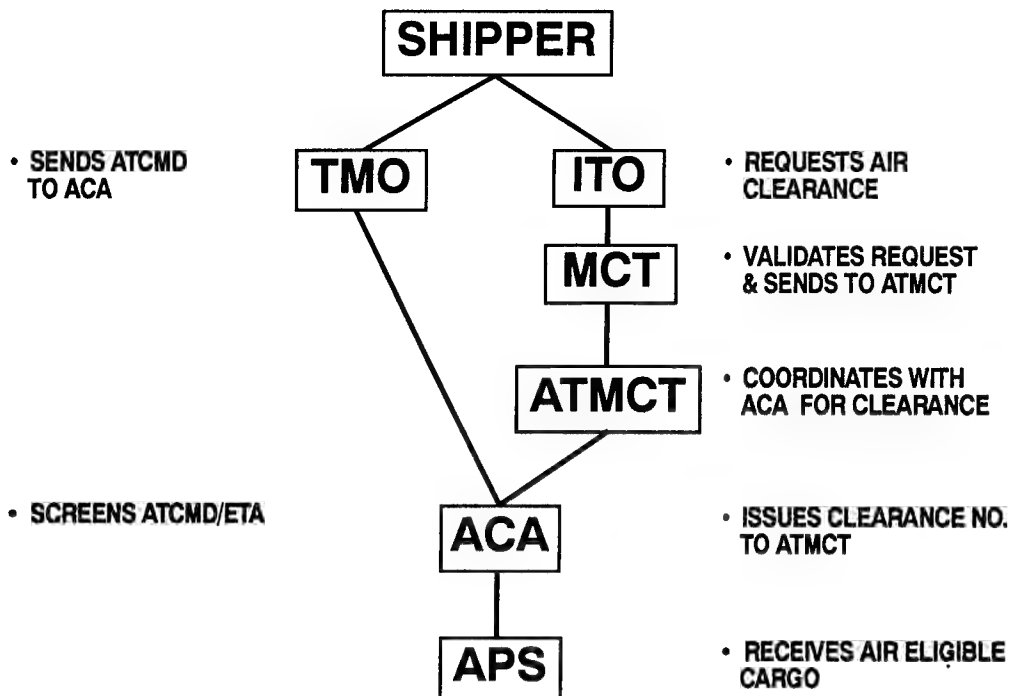


Figure 3. Communications between the primary transportation activities involves use of telex, FAX and phone.

Role of ACA During Wartime

During wartime or contingency operations, the ACA's role as USEUCOM representative becomes increasingly important. High priority shipments of all components must be expedited to their destination, and it is up to the ACA to keep these shipments moving. However, the ACA's primary responsibility is to control the flow of cargo through the aerial port.

When Rhein Main became a primary departure point in Central Europe for US forces and equipment deploying to the Persian Gulf region during Operation Desert Shield/Storm, the ACA was faced with the formidable task of controlling the flood of cargo rushing to the aerial port. They quickly transitioned to a wartime posture. Operations expanded to 24 hours a day. Individual Mobilization Augmentees (IMAs) were activated to full-time duty and augmentees from USAFE transportation units were sent to Rhein Main to support the ACA operation.

All originating channel cargo had to be cleared into the port to prevent a free flow of uncleared, ineligible cargo. The ACA worked closely with the TMOs and the ATMCT to hold the line on the amount of cargo arriving each day. Once the limit was reached for a particular day, they began clearing for the next day. It was not uncommon to have a three-day backlog of airlift clearance requests and be working on clearances for day four. Without this control system in place, the aerial port would have been overrun with free flowing cargo.

A Desert Shield Coordinating Office (DSCO) was established and operated out of the ACA to coordinate the arrival and processing of USAFE equipment packages. Shipment status reports were prepared and sent to USAFE headquarters daily. In addition, the U.S. Central Command sent a logistics

representative up to Rhein Main to help prioritize cargo loads for the European Desert Express mission. He operated out of the ACA and had direct communications with the Central Command Air Force logistics staff.

As a result of the Persian Gulf deployment experience, the role the ACA plays in the transportation system—particularly in the airlift clearance and control process—is now more fully understood. But more importantly, the experience helped define and validate the wartime mission of the ACA for future contingencies.

Conclusion

The ACA provides an essential service to both the shipper and the MAC aerial port. In peacetime or wartime, without the services of an active ACA at the port, cargo movement would certainly be less efficient. Whether its issuing clearance dates, fixing shipping documents, expediting a time sensitive equipment item, or conducting a tracer action for a late shipment, the ACA is primarily concerned with one thing—to keep the cargo moving into the channel airlift system as efficiently as possible.

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Captain Larberg is presently Commander, Detachment 2, 7317 Materiel Flight, Rhein Main AB, Germany.





CURRENT RESEARCH

Air Force Armstrong Laboratory FY91-92 Logistics R&D Program

The Air Force Armstrong Laboratory, Logistics Research Division, Wright-Patterson Air Force Base, Ohio, is the principal organization which plans and executes the USAF exploratory and advanced development programs in the areas of Combat Logistics, Acquisition Logistics, and Team Training Systems. Most of the Laboratory's efforts to improve Air Force logistics are managed within these sub-thrusts areas. Some efforts are undertaken in response to technology needs identified by the Laboratory, but the majority of the work is in response to formally stated requirements from various commands and staff agencies within the Air Force. Many of our projects vary from basic research aimed at producing new fundamental knowledge to applied projects which are intended to demonstrate the technical feasibility and military effectiveness of a proposed concept or technique.

Following are some logistics R&D projects managed by the Logistics Research Division, which will be active during FY91 and FY92. (Contact: Bertram W. Cream, DSN 785-3713, (513) 255-6797)

DESIGN EVALUATION FOR PERSONNEL, TRAINING, AND HUMAN FACTORS (DEPTH)

OBJECTIVE: To use existing computer-aided design (CAD) man-model technology and incorporate information relevant to Logistics Support Analysis (LSA), personnel, and training. This is a new direction in the use of computer graphics man-modeling.

APPROACH: Through simulation on CAD designs, the DEPTH user will be able to determine human factors and human resource requirements with respect to maintainability. These simulations will make such analyses easier and more accurate than current methods. The software will be housed in a computer graphic workstation and will be able to import CAD data. Designs can be displayed with surfaced images in three-dimensional space and will be capable of real-time manipulation. The program will "understand" how to construct maintenance tasks when given high-level commands from the user. Animation will be used to display results. Crew Chief, a man-model developed by the Air Force Armstrong Laboratory, will be the baseline for the ergonomic capabilities within DEPTH. (Mr Ed Boyle, AL/HRGA, DSN 785-9943, (513) 255-9943)

INTEGRATED DESIGN SUPPORT (IDS) SYSTEM

OBJECTIVE: To create and demonstrate an information system concept for gathering and disseminating critical technical data during the life cycle of a weapon system, from requirements definition and design through manufacturing, to deployment and logistics support.

APPROACH: The program objectives are: (1) define the critical subset of weapon system technical information required for sustaining engineering; (2) integrate design, manufacturing, and logistics technical data through the application of advanced computer technology so it appears to a user of the system as a single database; and (3) demonstrate this concept in a production environment using actual weapon system data. A major thrust of the program is to define the critical set of technical data required to support a weapon system throughout its life cycle. The result is the most comprehensive available information model for a generic weapon system life cycle in existence. A second major thrust is to define the specifications for an information system that can effectively manage massive amounts of complex technical data. Finally, IDS will be demonstrated in a production environment with actual B-1B data to show integrated, seamless access and configuration management of weapon system drawings, technical

orders, and logistics support analysis records. (Mr Jeff Ashcom, WL/MTI, and Mr Mark Hoffman, AL/HRGA, DSN 785-9943, (513) 255-9943)

INFORMATION INTEGRATION FOR CONCURRENT ENGINEERING (IICE)

OBJECTIVES: To develop technologies critical to effectively manage, control, and exploit information resources in support of concurrent engineering activities. To develop the theoretical foundations, life cycle support methods, and tools for Evolving Integrated Information System (EIIS) design, implementation, and evolution in support of concurrent engineering and CALS activities.

APPROACH: The products from this effort can be divided into four main areas: foundations, methodware, experimental tools, and technology transfer methods, techniques, and practices to support integrated information system development and evolution throughout its life cycle. Experimental tools development is directed at reducing the costs associated with developing and evolving integrated information systems. Technology transfer products will include papers submitted for publications, strategic management transition plans and prototype tools for system design, development, and maintenance. The resulting technologies will provide a structured, engineering approach to the overall life cycle activities associated with the strategic and tactical planning, definition, engineering, design, implementation, and maintenance of EIIS. (Capt Mike Painter, AL/HRGA, DSN 785-9943, (513) 255-9943)

RELIABILITY, AVAILABILITY, AND MAINTAINABILITY IN COMPUTER AIDED DESIGN (RAMCAD)

OBJECTIVE: To develop methods and techniques of integrating reliability, availability, and maintainability (RAM) into weapon system design through the use of computer aided design/engineering (CAD/CAE) workstations.

APPROACH: The RAMCAD Software Integration Project is a two-prong effort. The first part, which is a joint effort with the Army Armament Research Development and Engineering Center, involves creating software shells to integrate various off-the-shelf RAM analysis software into a CAD/CAE workstation. The second part includes conducting long-term research into the use of artificial intelligence to aid in analyzing a design for various RAM attributes and suggesting techniques to improve the design. Products from these efforts include: (1) a prototype RAMCAD system for demonstrating reliability, maintainability, and supportability packages to improve electrical, mechanical, and structural design. (2) reports on the electronic design process, and (3) report on the methodology and evaluation of a reliability and testability decision aid for the electronic designer. (Mr Matthew C. Tracy and Mr James McManus, AL/HRGA, DSN 785-9943, (513) 255-9943)

INTEGRATED MAINTENANCE INFORMATION SYSTEM (IMIS)

OBJECTIVE: To develop a prototype integrated information system for the flight-line maintenance technician which will provide all the diagnostic, technical order, training, and work management data needed for job performance.

APPROACH: A prototype Integrated Maintenance Information System (IMIS) is being developed to demonstrate the capability to access and integrate maintenance information from multiple sources for use by the maintenance technician. IMIS will provide the technician with direct access to many different maintenance information systems including historical data collection and analysis, supply, technical orders, and automated training systems.

(Continued on page 36)

Inside Logistics

Exploring the Heart of Logistics

The TPFDD Crisis Management System

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The robusting of War Readiness Spares Kits (WRSK) and Base Level Self-Sufficiency Spares (BLSS) at operational units is one of the most significant actions taken by Air Force logisticians during contingencies. Flying units tasked to participate in the contingency must depend on their WRSK/BLSS during the early stages of the conflict until a logistics pipeline is in place. Robusting activity at all levels and particularly at an air logistics center begins as soon as the tasked units are identified. A second important action involves the identification of which components or parts are in short supply and are needed to support the flying units on a long-term basis.

Both of these actions are critical to the success of the Air Force mission. Obviously, being able to accomplish them in the most efficient manner is of the utmost concern to everyone involved. Therefore, when a group of logisticians at San Antonio Air Logistics Center developed a "better way," it was big news throughout the Air Force Logistics Command.

Background

In the past, the most critical portion of the overall process was extremely time consuming. It involved determining which Stock Record Account Number (SRAN) applied to each of the units involved as depicted in the CINC OPlans Time-Phased Force and Deployment Data (TPFDD). This was necessary so individual weapon System Program Managers (SPMs) could determine which of their SRANs were involved in the contingency and, therefore, would require their attention. Engine managers needed the information as well. During the recent Desert Storm conflict, the process was repeated on a recurring and frequent basis since TPFDDs were dynamic and subject to change as often as twice a day. An analysis had to be accomplished each time a TPFDD update was produced. For the most part, manual methods were used to analyze the TPFDDs, produce a report called a Chart 10, and provide this very critical information to the SPMs and engine managers. The lack of automated methods also caused much concern because of the potential for error and the possibility of serious consequences, shortfalls, or misalignments which might result in inadequate support for our fighting forces. This, plus an overriding concern about the time involved in analyzing the TPFDD and producing reports, caused logisticians/planners throughout AFLC to seek a

computerized means of accomplishing TPFDD analysis. The group at San Antonio was the first to develop a viable program.

What is the program called?

The program is called the TPFDD Crisis Management System (TCMS). It was developed by a team of individuals which included logisticians in the war planning branch, a computer scientist, a computer operator, and a management assistant. Their names are Roland Maldonado, Gerald Rumpf, Michael Garza, Keith Padgett, Kevin Gannon, and Mario Gonzalez. Two of the individuals became aware of the need for such a system and enlisted the aid of Mr Garza, who manipulated the TPFDD for them; Mr Padgett, who wrote the computer program to process the data; Mr Gannon, who served as a computer operator; and Mr Gonzalez, who performed various administrative functions while the system was being developed.

What is the source of the data?

Most of the data used is from the TPFDD itself, which is resident in a subsystem of the Worldwide Military Command and Control System (WWMCCS) called JOPES or Joint Operations Planning and Execution System. The focal point for the WWMCCS at the air logistics center located and refined procedures for downloading the TPFDD from the WWMCCS to a floppy disk, which allowed the programmer to apply his PC program and match units with their supporting SRANs. The SRANs, which had been manually loaded into the TCMS database earlier by the team's administrative personnel, can be updated as required. The war planners assisted in the development of TCMS by determining which data from WWMCCS was critical to the process, testing TCMS, and recommending refinements.

What were the problems in developing TCMS?

Several challenges had to be overcome before TCMS became a reality. The first was to determine which data should be extracted from the TPFDD and input to TCMS in order for TCMS to function properly. Many man-hours were spent brainstorming and identifying the necessary data elements. The team finally decided they first needed to identify the type of weapon system, home-base, and deployment date of the units involved. This, in turn, would give them the engines, major components, and other commodities associated with the weapon system. They also developed the various reports produced by TCMS. Once these determinations were made, the programmer began work on the program. Next the procedures for downloading the TPFDD elements from JOPES to a floppy disk were refined. This was no easy chore since WWMCCS is a TOP SECRET system and TPFDDs are normally routed to a printer,

not a floppy disk. For this reason, all downloaded data had to be sanitized to avoid the possibility of compromise. Fortunately, a software package was available from Headquarters AFLC for that purpose. After considerable effort, the team also succeeded in devising a way to route the data to a floppy disk. At the same time that the classification problem was being resolved, the programmer was pressing on with the development of TCMS using Nantucket Clipper Summer of 87 software. One challenge he faced involved programming TCMS to differentiate between an active file and a historical file, which would allow him to identify new data each time the program was run. He was successful.

In fact the TCMS software is so well developed overall that it is maintenance free. For example, if data is accidentally erased or a hard disk is lost, recovery can be accomplished in minutes without any assistance from a technician or a programmer. It also handles real-world and exercise data simultaneously. One key feature of TCMS allows operators to be selective as to which data they portray in a particular report. Another alerts operators to the fact that newly input OPlan data contains a flying unit for which no SRAN exists in the database. This means the SRAN must be researched and added to the system. Without this capability reports generated could be incomplete. This is a system which truly meets the needs of its users. Some of the significant data screens which are a part of TCMS are featured in this article along with an explanation of each.

What are the advantages of TCMS?

TCMS reduces the time to analyze TPFDDs by a factor of 5 to 1. The system is also much more accurate than the manual method and significantly reduces the possibility of error. But that

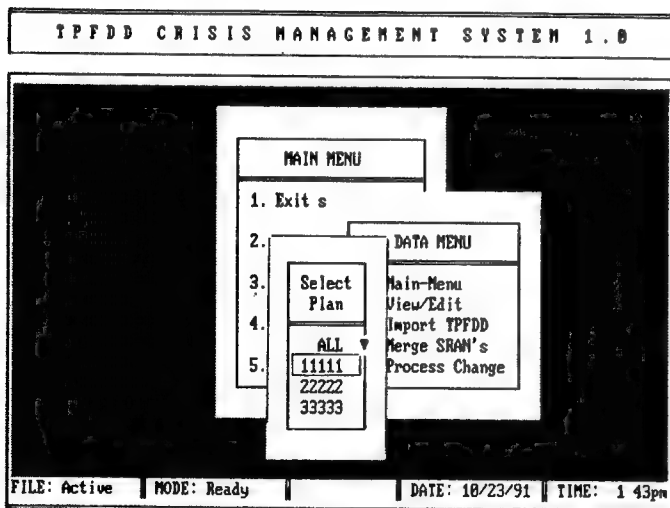
is not all; not only do SPMs and engine managers have complete and accurate data as to the SRANs involved in the contingency, but inventory managers know whether the components they manage are also involved, even if the weapon system is managed at some other air logistics center. This is significant because parts can now be released based on TCMS reports rather than waiting on a requisition from the unit. All this translates into vastly improved support to the operating commands during contingencies.

What are the monetary savings to the Air Force?

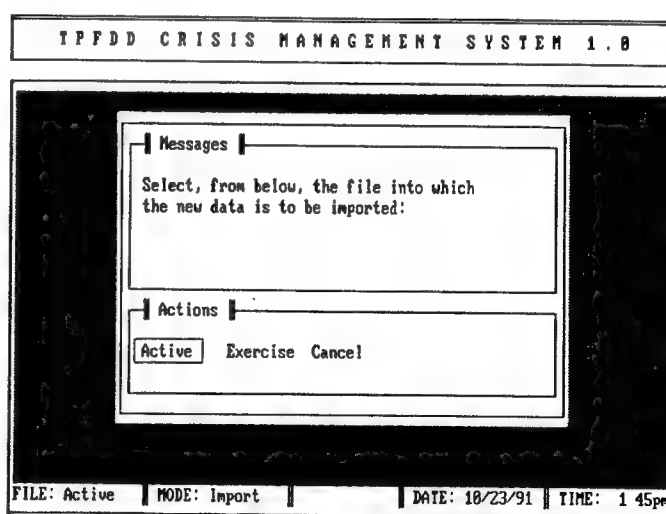
In a normal year void of real-world contingencies, TPFDDs are analyzed during exercises, feasibility/capability studies, etc., at a cost of around \$64,000 across the command. TCMS will reduce that cost to \$12,000, which is an annual savings of \$52,000 for AFLC alone. Had TCMS been available during the entire Persian Gulf War, AFLC would have saved approximately \$123,000. A modification is currently under consideration which will allow the base Installation Mobility Officer and others to also utilize the system which will mean additional savings for the Air Force.

Who else may be utilizing TCMS?

Headquarters AFLC has been briefed on TCMS and the system has been exported from San Antonio Air Logistics Center to the other four Centers within the Command. Also, Headquarters USAF is aware of TCMS and is interested in its applicability DOD-wide. TCMS is easily installed and transportable to any location with minimum programmer or technician support.




The "VIEW/EDIT" option of the "DATA MENU" enables the user to select the data the user desires to view. The user can select to view, or "Browse" all of the records in the currently selected file or, only those records associated with a specific Op-Plan number. The currently selected file can be identified on the systems status line at the bottom of the screen. "FILE" which of the four (4) system files the user is currently working. The four system files are the a.) Active File for current "real-world" data, b.) History File for the previous TPFDD data import, c.) the Exercise File for use during "Exercise" scenarios (or simultaneous processing) and, d.) the Exercise History File for previously imported Exercise data. The user may open and use any of the files by selecting "3. Change Files" option from the "MAINTENANCE MENU."



The TPFDD Crisis Management System enables the user to operate using both "real-world" data and, "exercise" data simultaneously, without compromise to either data set. All "exercise" data reports are prominently identified as "EXERCISE." As shown in the figure above, upon importing a new TPFDD data set, the system queries the user as to the "mode," or "file" the user would like the data imported, "Active," or "Exercise." This feature enables the organization to maintain consistent TPFDD management in either event without degrading the functionality of either process. This capability also enables the organization to incorporate lessons learned, and improvements made, directly into the "real-world" management of the TPFDD process.

Summary

In summary, personnel at San Antonio Air Logistics Center have developed a truly useful computer program. It saves money; but, more importantly, it saves time and makes a

tremendous improvement in the accuracy of TPFDD processing. This is essential when SPMs are working to ensure flying units are ready to deploy and are supportable on a long-term basis. There is no doubt this effort will some day make a difference when the Air Force goes to war again. 

TPFDD CRISIS MANAGEMENT SYSTEM 1.0

Messages

Checking Recd.: 44 of 44 Completed: 100.00%

Not Changed: 34 Exceptions: 10

 Added: 0

 Changed: 10

 Deleted: 0

Actions

Print an Exception Report (Y/N)?

FILE: Active MODE: Changes DATE: 10/23/91 TIME: 1:45pm

As a TPFDD data set is imported into the system, the TPFDD data set currently residing in the "Active" (or "Exercise") file is moved into the appropriate "History" file and the new TPFDD data set replaces the data that was moved. The system then compares the two files, "Active" and "History" to identify the changes between the two sets of data. This particular feature of the program precludes the user from scanning each data set to identify precisely what has changed, especially when data sets are received in a short span of time. All of the changes in the data are reported to the user both in reports, and in the "VIEW/EDIT" window. This enables the using organization to focus its attention on the dissemination of the data, and necessary changes, to the appropriate officials for immediate action as required, thus eliminating a lengthy manual process and increasing throughput of the data and the process.

TPFDD CRISIS MANAGEMENT SYSTEM 1.0

LOOK-UP TABLE MAINTENANCE

BASE: UIC: SRAN:

EGLIN AFB	1A1MPT	FB1111
EGLIN AFB	1B1MPT	FB1111
EGLIN AFB	1C1MPT	FB1111
EGLIN AFB	1D1MPT	FB1111
EGLIN AFB	UIC CG	FB1111
HICKAM AFB	2AHICK	FB2222
HICKAM AFB	2CHICK	FB2222
HICKAM AFB	2DHICK	FB2222
HICKAM AFB	2EHICK	FB2222
HICKAM AFB	2FHICK	FB2222
KELLY AFB	3AKELL	FB2059
KELLY AFB	3BKELL	FB2059

COMMANDS:

Esc = Quit

Enter = Edit

Del = Delete

F2 = Locate

F3 = Reindex

F4 = Bld Tbl

F5 = Pack

FILE: Active MODE: LookUp DATE: 10/23/91 TIME: 1:46pm

The "Look-Up Table" provides the mechanism for the system to match Stock Record Account Numbers (SRAN's) with the appropriate Base and Unit, the Unit being identified by the Unit Identification Code (UIC). The Look-Up Table is created by the using organization upon installation of the TPFDD Crisis Management System. Subsequent to the initial creation of the table the using organization is only required to maintain the table as changes occur or, as identified by the "SRAN TABLE EXCEPTIONS" produced by the "Merge Sran" option in the program. The system will use the table for all subsequent matches, without further intervention from the user.

To limit the amount of data entry required, option "F4=Bld Tbl" can be used to enter the Base and UIC the system finds during the first TPFDD data import. The user then only is required to find and enter the SRAN matching the Base and UIC that has been built into the table. Again, this process is only done once—on the initial installation of the system, to identify to the system the Bases and UIC's managed by the using location. All future TPFDD data imports will then use the existing Look-Up Table.

Other "Look-Up Table Maintenance" commands provide complete user maintenance functions for their Look-Up Table. Records can be added, deleted, edited, and the Table can be reindexed "on-the-fly" during maintenance. The using organization has complete control over the data managed within the Look-Up Table for its location.

The "USAF Logistics Policy Insight" department will resume publication in the Spring issue.

Forecasting and Modeling Using PC-Based Software: A Challenge and an Opportunity for Professional Logisticians

Steven M. Schenk, C.P.L.

Background

PC-based software for modeling and forecasting presents both an opportunity and a challenge for the logistician in the high-technology era. It is an opportunity for each of us to do our analysis job better, yielding results more quickly and more accurately. It is a challenge for us to use these high-technology tools correctly and to educate the non-logisticians in their application and interpretation. The professional logistician must understand the implications and impacts of PC-based methods in order to make the best use of this technology.

Introduction

Decision making is the prime responsibility of the manager; he must choose the course of action believed to be most effective and efficient in meeting the goals and objectives of the organization. Our goal as professional logisticians is to provide accurate and reliable counsel to the manager/decision maker, helping to allocate resources more wisely to meet those objectives. One way to do our job better is through the use of PC-based modeling and forecasting.

Mr E. S. Quade in his excellent book *Analysis for Public Decisions* defines the role of Modeling and Forecasting. (1) Quantitative analysis is often applied when the decision maker has little previous experience making similar choices, when the alternatives are complex, or when the decision is considered important enough to expend the time and effort required to conduct extensive analysis. There are a variety of quantitative analysis techniques which may be applied, including forecasting and modeling.

Mathematical models are used to describe the real world; many are good representations, but none are perfect. Users of mathematical models hypothesize that quantitative analysis can augment their qualitative judgment. Some subjective judgment must always be applied throughout a program—resolving questions such as which assumptions to use, what approach to apply, and what conclusions to draw. Judgment is universally applied—by either the analyst or the decision maker.

The application of PC-based modeling and forecasting has become both an art and a science. Scientific principles must be applied, including mathematics, statistics, computer science, and parametric routines. At the same time, it is an art, in that the proper application of appropriate quantitative analysis is a difficult talent to master, and there are few guidelines for the judgment required.

The Issues Faced

One issue logisticians are faced with is the need to forecast the impacts of system level improvements in reliability and maintainability upon improving the supportability of both proposed and fielded weapon systems. The means to accomplish this analysis have evolved from slide rule to mainframe to

calculator to Personal Computer (PC). Calculations which once took hours and yielded approximations now take seconds and give answers with multiple decimal places.

Logisticians need to understand the PC modeling and forecasting process, including what problems can be addressed, when to apply a certain technique, and how to present the results. Problem formulation, "asking the right questions," is more important than manipulating numbers and churning out answers. The program manager (usually without a supportability background) must be able to depend upon the logistician to employ the correct analysis method. The professional logistician must understand how to apply correct analysis methods or techniques and how to avoid fallacious mathematics. Finally, our results must be presented properly to be understood and acted upon. In these days of budget tightening and extended service lives of products and systems, life-cycle supportability cost is becoming the most important facet of many development programs.

Rear Admiral Larry Marsh challenged logisticians attending the 58th Annual Military Operations Research Society Symposium to perform analysis tasks better. (2) Three distinct challenges (and opportunities) for PC-based modeling and forecasting to help us perform better are:

- (1) The problems we face are becoming increasingly more complex.
- (2) A multitude of different methods, models, and techniques are being applied.
- (3) The results of our analysis are becoming more visible, with supportability having a greater impact on the systems engineering process.

The Challenge to Solve Complex Problems

There is no question that advancements in technology can be applied to the logistics modeling and forecasting process. The only limiting factors are the education and motivation of the individual analyst. The challenge is to solve these complex problems in the most effective and efficient way. Effective analysis solves the correct problem; efficient analysis solves the problem correctly.

The problems we face are often enormously complex, with complexity measured by the potential for multitudinous input variables and extensive computations impacting the solution. It is difficult for the human mind to consider every variable, and the computations can become tedious. These factors could lead to a solution which does not properly consider all relevant information or becomes bogged down in unnecessary detail.

The computer, and especially the Personal Computer, has helped us overcome these problems. The computer can keep track of many more variables, and calculations are quicker. Techniques which once may have been avoided because they were laborious now become easier to employ. Sensitivity analysis is much easier because the time to compute is reduced.

A lot of software exists to meet virtually any required application; alternately, tailored methods may be developed using PC-based programming or spreadsheet applications.

Solving analytical problems is still possible using a stubby pencil on the back of an envelope, but such analysis does little to build on the trust and confidence placed in the logistician. The mainframe computer should not be ignored, but sometimes setting up the model becomes more of a chore than finding and interpreting the solutions. This is not to say that only PC-based methods should be recommended. There is a place for complex methods possible only on the mainframe, and there is a place for quick approximations using a calculator. Wise program managers will appreciate being told they can obtain a credible response with minimum essential analysis. The responsibility of the analyst is to recommend that level of analysis required. The proper place to start is to ask the right questions. This will require close liaison among the analyst, the design team, and the program manager early in the program. We must understand the problems that need to be solved and the degree of accuracy desired. We must also avoid the temptation of doing analysis just for the sake of analysis. Given this knowledge, we can formulate the problem correctly and identify any constraints. We must discuss the requirements and the methods we intend to use with the decision maker we are assisting. Also, we must reach a consensus on assumptions, requirements, methods, and applications of results.

There is a peril to avoid—the peril of attempting too much and making impossible promises to the program manager. Some problems may simply be too complex and need to be broken into manageable pieces. Some problems may not yield to an effective solution, only approximations. This is acceptable if we identify our recommendations as based on approximations, with an associated level of risk. It might not be possible to reach an efficient solution given the allocated cost and schedule; again, we must approach the program manager with the predicament, along with a recommended course of action to meet the needs of the program. Identifying these obstacles as early in the program as possible will lead to a smoother resolution.

The Challenge to Choose From a Variety of Methods

There is a clear challenge we face when trying to choose from among the variety of software methods available on our PC, in attempting to apply the right tool to the right job. If our goal is to apply sound analysis, we must pick the appropriate method to meet the needs of the program. There is no one model or technique that is applicable in all cases, although familiarity often leads to frequency of use. There is an old saying, "If all you have is a hammer, every problem looks like a nail." Whatever forecasting or modeling techniques are applied, and whatever tools are used to conduct the analysis, the approach must not only be appropriate but also must be understandable. Our analysis must be appropriate; we must determine to solve the right problem using the right method, and our results must be timely. Too often we strive for an overly elegant solution. A complex mathematical problem may be interesting to solve, but may also be a waste of time and money. Ask your program manager what questions need to be answered and when the answers are needed. Then pick the most effective and efficient method to meet that objective. A good approximation today may be much more valuable than an exact answer two weeks from now.

Our logistics analysis methods must be understandable; our work should be based on a common sense approach to the needs

of the program, not a mystical application of complex mathematical expertise or an obscure model. Our credibility is enhanced when we take a more active part in the program and demonstrate the utility of supportability analysis. When our function is understood, our analysis can be accomplished more quickly and with greater accuracy.

Using known models and methods also guarantees that the results are reproducible by another analyst using the same model with the same inputs. The integrity of the input data is enhanced when the method uses standard data from dependable sources. When managers are comparing programs competing for the same resources, it allows them to equate the costs and benefits using the same measures of merit.

There are mistakes to avoid when choosing the model or method to use. In this case, unfamiliarity breeds contempt—if a model is available but unfamiliar to analysts, they will seldom opt to use it. The same applies to input data; ease of data collection will too often steer us towards one particular method. As professionals, we must also be careful of novices applying supportability analysis without an education in the implications of their analysis. This is an additional opportunity for us to screen such work for the program manager.

The Challenge to Increase the Visibility of Solutions

Supportability analysis is becoming increasingly important as program managers realize there are long-range, positive impacts on cost, schedule, and performance obtainable through proper attention to logistics. We must make our analysis credible; that is, customers must believe that the answers and advice we give them can be acted upon with little risk. We need to apply professional standards and be realistic in our guarantees. We must deliver solutions that convey a feeling of trust in the integrity of the results.

PC-based methods present an opportunity to increase this trust and confidence. The modeling method we choose may not be understood by the manager and may in fact be unquestioned because it is not understood. Choosing a recognized model or technique increases the reliance in its use. State assumptions so the manager understands indeterminate areas. Identify the consequences of bad assumptions through sensitivity analysis. Make sure the level of risk is understood and accepted.

Understandability of solutions is enhanced when the results of the analysis can be presented both numerically and graphically. We must build our reputation for presenting the results accurately and fairly. It is not difficult to present the same facts and figures to prove differing suppositions. Deception through the use of faulty logic or misrepresentations is possible; we should avoid such chicanery and learn to recognize it in other programs. The book *How To Lie With Statistics* by Darrell Huff explains how to recognize duplicity by asking the right questions. (3) Greater accuracy is dependent upon better input data; the number of significant figures in the answer will always be a function of the credibility of the inputs. Analysis methods can be used to make comparisons based on relative merits, and sensitivity analysis can overcome some of the inexact inputs we are forced to use. Here is an opportunity for us to apply PC-based techniques to compensate for indefinite inputs, through the speed and accuracy of sensitivity analysis.

Conclusions

We logisticians have an excellent opportunity to put technology to work in the arena of PC-based modeling and forecasting, to expand our role in the analysis cycle, and to

The Issue	The Challenge	The Opportunity
Complexity of Problems	Is it possible to find a timely solution given the complexity of the problem and the many variables involved?	Apply technology, including PC-based models, to solve increasingly more complex problems.
Variety of Methods	Which method, model, or technique will best meet the needs of the program?	Choose the right tool for the right job, given the expanse of methods available.
Visibility of Solutions	Does the solution make sense? Is it understandable? Does it meet the needs of the program?	Increase the impact of supportability analysis in the system engineering process.

Table 1.

improve our reputations as professionals. As we build that trust and confidence among decision makers, they will come to the logistician more frequently and for a wider range of questions. Of course, this is totally dependent upon us providing credible and responsive answers. As this cycle continues, the need for further modeling and analysis by the logistics community will grow. This will be possible only as the program managers see the usefulness to their programs.

Unfortunately, each of the positive impacts is accompanied by the potential for a negative consequence. Solving more complex problems is not always possible with a high degree of confidence. A variety of easy-to-use methods available frequently leads to abuse by untrained or unfamiliar users. Limitations in interpretation will exist long after the impediments faced in using a particular method are removed.

In order to guarantee the right problems are solved, there must be a close interface between the design team and the logistics analyst. Not only will this make the logistics program more responsive to the needs of the program, but it will make the other design disciplines more responsive to the needs of the logistician. For example, most of the models and techniques we use are "data hungry"; the only way to collect that data is by interfacing with the engineers and technicians doing the design. If they work closely with us on a frequent basis, they will be more receptive to our requirements.

Logisticians must know where to locate credible input data for the model or technique chosen. If the input data we use is suspect, our results and recommendations will be suspect. We must be knowledgeable enough to ask the right questions about


both the inputs and outputs of an analysis, and then act to correct any deficiency.

Above all, logisticians must be skilled in interpreting the results of an analysis for the decision maker. Not everyone understands the implications of supportability analysis; many program managers do not even have a clear understanding of logistics terms. If supportability is to be co-equal with cost, schedule, and performance, we must translate our recommendations to be understood. Finally, logisticians must be tactful but emphatic in dealing with supportability related analysis conducted by amateurs. Too often we hear that logistics modeling and supportability analysis is just common sense, able to be performed by any smart person. We must show that our superior knowledge and skills lead to a more responsive and credible solution.

Table 1 describes the issues, the challenges, and the opportunities for professional logisticians in the high-tech era.

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CAREER AND PERSONNEL INFORMATION

Logistics Professional Development

Civilian Career Management

High Tech/High Touch on the Leading Edge: The Standard Systems Center

The challenge is out there! Are you ready for it? If you want to apply your functional knowledge and computer expertise in developing innovative computer applications and technologies, then a job at the Standard Systems Center (SSC) is for you!

We live in an information society. The Air Force—and, more specifically, the Supply community—is a microcosm of this. Our job today is the same as it always has been—taking care of our customers. But, the way we service our customers sure has changed and will continue to change, right along with the Air Force. We've become dependent on computers to do our job.

Today, the SSC Supply Directorate is stepping out and shaping the future of computer technology and applications within the Supply community.

Our changing Air Force culture is spawning numerous initiatives. One such initiative which will have far-reaching impact on the Supply community and our customers is Regionalization. This regional centralization of Supply's computer system creates a unique challenge. The SSC must effect a myriad of computer hardware/software changes and yet, to the customer in the field, these changes must be transparent to the maximum degree possible.

An SSC assignment is a career-broadening assignment, without the program label. People assigned to SSC supply jobs are first and foremost SUPPLY OFFICERS. Computer literacy helps but is not a prerequisite. You should have solid base-level supply experience, be a good communicator, want project management/leadership responsibilities, and be spring-loaded to make real and visible contributions to Supply. More than before, today's environment is one of change both in the automation world and the supply procedures world. SSC supply officers can and will make a difference. If you've ever found yourself excited about making programs like the Mission Capable (MICAP) Asset Sourcing System (MASS) and Stock Funding of Depot Level Reparables (DLR) work better; or if you've ever had burning ideas about dumb policies, procedures, or programs, then SSC is the place to make your mark. There's not another place in the Air Force where an officer can have a greater effect on Air Force Supply than at SSC. The opportunities in the Supply Directorate at the SSC are for captains through lieutenant colonels.

A tour at the SSC prepares you for jobs at the MAJCOMs and Air Staff in the policy/procedure business where future supply policies are set. If you're up to the challenge of the SSC, get your Form 90 up-to-date and call me.

(Capt Mary E. Clarkson, HQ AFMPC/DPMRSL3, DSN 487-6417)

LCCEP

It has been 11 years since the largest and oldest civilian career program, the Logistics Civilian Career Enhancement Program (LCCEP), was launched. The original objectives, which are still valid, include:

- Developing highly skilled professional logisticians.
- Providing the best candidates for Air Force jobs.
- Identifying high potential personnel.
- Encouraging broadening at intermediate levels.
- Providing equal employment opportunity.
- Ensuring all actions are based upon merit.

As you know, we have fine tuned the program over the years. Our objective has been to make the LCCEP fully responsive to all the needs of each registrant and also of senior logistics management. In fact, we all benefit when the best people are in each job. Our goal has been to identify, develop, and facilitate the matching of persons and positions.

Almost two years ago, we undertook a major TQM-type review of LCCEP to determine whether there are additional changes we should make as we head into the second decade of LCCEP. As you might expect, improvement is always possible and there will be some changes.

The Marines look for "a few good men"; in LCCEP we look for many "super people." In determining whether we are meeting this objective, we evaluated promotion rates for cadre members. Although, percentage wise, more cadre personnel are being promoted than non-cadre, many promotions have gone to those who were not selected for the cadre. Does this mean we haven't the right criteria for selecting into the cadre, or does it mean we have lots of good people who just missed the cut-off for cadre? We concluded both of these situations exist.

So, we have looked hard at determining how to identify and select personnel for development and promotion, and thereby for cadre designation. In fact, we hired one of the outstanding human resources firms in the country to help us in this project and to validate the results for us.

With the advice and counsel of the human resources folks, we have evaluated the careers of "successful civilian logisticians" in the GM-13 and above categories. We have identified 11 behavioral competencies which have high correlation to success in the logistics career field:

1. Demonstrates Customer Service Orientation.
2. Demonstrates Entrepreneurial Achievement.
3. Demonstrates Tenacity.
4. Develops and Directs Others.
5. Maintains Flexibility.
6. Performs With Self-Confidence.
7. Takes Initiative.
8. Uses Conceptualization and Strategic Behavior.
9. Uses Judgment and Analytical Thinking.

10. Uses Strategies to Influence.
11. Works Effectively Through Others.

Accordingly we are restructuring our evaluation and interview process to reflect these findings.

We have also determined that more positions should be included in the formal LCCEP program and that greater central management attention should be given selections to the GM-13 and above levels. As a result, all GM-15 and GM-14 logistics positions and 80% of GM-13 logistics positions will now be filled using LCCEP certificates. We will, however, continue to provide information on career paths and the types of experience requisite for advancement into the more senior grade levels, to registrants below the GM-13 level.

The changes being made to LCCEP include the use of a written competency evaluation to be prepared by supervisors for all registrants, GS/GM-13 and above. For GM-13s and GM-14s, there will also be an interview which will elicit additional insight into these competencies for those who seek promotion.

Each LCCEP registrant will receive a whole person score. The categories/elements of the whole person score are shown below:

Professional Experience		80
Multi-Occupational Series	24	
Multi-Command	16	
Multi-Level	16	
Management/Supervisory	24	
Education/Training		80
Formal Education	48	
Professional Military Education	12	
Professional Civilian Education	12	
Certified Professional Logistician	8	

Performance Appraisal	100
Competency Assessment (GS/GM-14 and -15 eligibles only)	200
Interview	60
Written Assessment	140
TOTAL	460

The whole person score for GS/GM-13 and 14 registrants will be the basis, along with experience, for inclusion on LCCEP promotion certificates. Those persons in the highest percentile will be designated cadre, but the important consideration is that all GS/GM-13 and 14 registrants will receive the benefit of the whole person score in consideration for promotion.

The improvements in LCCEP will be phased in over the next six months. Detailed information about the LCCEP changes will be distributed shortly to all LCCEP registrants. In addition, LCCEP's master development plan is being updated to incorporate program improvements and will also be sent to all registrants. We will start using the new whole person score for promotion and cadre designation purposes on 1 October 1992. The whole person score will also be used in ranking persons for development opportunities, such as long-term, full-time training. Same aspects of these refined procedures are being studied for application at GS-12 and below levels.

(Lloyd K. Mosemann II, SAF/AQK)

(NOTE: This information is being printed in pamphlet form for distribution to all LCCEP registrants.)

Continued from page 28

The prototype IMIS will consist of a portable computer for flight-line use, a workstation for use in the shop, and an aircraft interface panel for interacting with aircraft systems. Design of the prototype IMIS is based on the results of structured requirements analyses, previous diagnostic and technical order demonstrations, and prototype field tests. IMIS prototype hardware will be field tested in an operational environment to evaluate the design requirements for integrating and displaying maintenance information. Specifications are being developed for use in procuring IMIS for operational application. (Mr Richard Weimer, HRGO, DSN 785-3871, (513) 255-3871)

CONTENT DATA MODEL (CDM)

OBJECTIVE: To develop a specification based upon the Content Data Model (CDM) for exchanging integrated databases of technical information for maintenance operations.

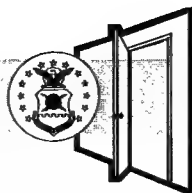
APPROACH: The Laboratory has iteratively developed the CDM from specific requirements received from the defense industry and various government groups. Demonstrations and reviews of the CDM have been conducted and the results have been documented in the Interactive Electronic Technical Manual Revisable Data Base (IETMDB) specification. The IETMDB is one of three specifications developed by the Tri-Service Working Group for Interactive Electronic Technical Manuals (IETMs). The IETMDB specification describes how to create and maintain digital technical information for display on electronic devices. Using these specifications will enable the services to improve weapon system maintenance by improving the quality of technical data and will reduce life cycle costs attributed to creating, distributing, and updating technical information. A test of the CDM concept and the IETMDB specification will be performed in the upcoming Integrated Maintenance Information System (IMIS)

Diagnostic Demonstration using the F/A-18 as the testbed. (1Lt Bryan Caporlette, HRGO, DSN 785-3871, (513) 255-3871)

INTEGRATED MAINTENANCE INFORMATION SYSTEM (IMIS) DIAGNOSTIC DEMONSTRATION

OBJECTIVE: To evaluate the capability of maintenance technicians to perform complex on-equipment diagnostic tasks, and the associated remove-and-replace tasks, using an automated technical order system containing improved technical data and diagnostic algorithms.

APPROACH: A prototype portable computer has been developed that plugs into the maintenance bus on advanced aircraft. This portable aid will download the built-in test data that resides on the bus and then will incorporate that data into the diagnostic algorithm contained in memory. The technician will be given the next best test until the fault is found. Then remove-and-replace instructions will be provided at the appropriate level of detail for the technician. Two organizational level demonstrations are included in the program. The first demonstration was conducted at Homestead Air Force Base in May 1989 using the F-16A/B aircraft fire control radar as the testbed. A small sample set of faults was inserted on the aircraft. The prototype portable aid with improved technical data, including diagnostics, assisted the technicians in performing the fault detection/isolation and the necessary corrective actions. The second demonstration will be with the Navy's F/A-18 aircraft in April 1992. The purpose of this demonstration will be to test the enhanced diagnostic algorithm and improved technical data and to evaluate the Tri-Service Working Group's Interactive Electronic Technical Manual (IETM) specifications. The sophistication of the built-in test capability on the F/A-18 will permit a field test that demonstrates the future potential of advanced, job-aided, interactive, on-equipment diagnostics and improved technical information. (1Lt Eric Carlson, HRGO, DSN 785-2606, (513) 255-2606)



A key component of the AFIT Graduate Systems and Logistics Programs is the research efforts involved in the master's theses that all students complete. Many of these efforts are sponsored by agencies throughout DOD and the USAF. In this issue, we highlight those theses produced by the 91S Class which received awards as superior research efforts. A copy of each thesis is available through DTIC.

AFIT Commandant's Award

(Most exceptional research contribution to the student's field)

Title: *Stockless Medical Materials Management: Applications for the United States Air Force Medical Service*

Author: Capt Thomas M. Harkenrider

This research studied stockless materials management to determine if it could improve the Air Force Medical Service's supply operations. The main result of this study was a decision support system (DSS) that would evaluate potential savings if stockless materials management were implemented in an Air Force medical treatment facility (MTF). Stockless materials management in ten civilian hospitals was studied in the process of developing the DSS. Data included facility bed-size; annual medical supply purchases; and, pre- and post-stockless numbers for medical supply full-time equivalents, for official inventory, and for warehouse requirements. Data analysis using linear regression resulted in the development of a mathematical model for inclusion in the DSS. The model reveals there is a potential for reduced supply costs with the implementation of stockless materials management in Air Force MTFs.

Dr. Leslie M. Norton Pride in Excellence Award

(Outstanding quality) Four 91S recipients

Title: *Performance Assessment of the Spare Parts for the Activation of Relocated Systems (SPARES) Forecasting Model*

Author: Capt Paul L. Bunker

This research assessed the performance of the Spare Parts for the Activation of Relocated Systems (SPARES) forecast model used to develop the spares requirements forecast for the August 1988 activation of the 174 TFW at Syracuse ANGB NY. SPARES was developed by the Air Force Logistics Management Center in August 1988 to replace existing Standard Base Supply System (SBSS) forecasting procedures. SPARES uses mission change data (MCD) from five similar-size source bases to determine the probability of future demand (PFD) for items at the gaining base. Before implementing SPARES in the SBSS, forecast performance must be measured and model weaknesses identified and corrected. SPARES correctly forecasted 72% of the demanded items when a PFD of 20% was used; however, 58% of the items forecasted did not have subsequent demands. SPARES forecasted 692 items which had less than two customer demands at the five source bases combined. This indicates either the model's program coding is incorrect or deficiencies exist in theoretical program logic. Deficiencies in the MCD collection

system also had an impact on SPARES performance. Based on these findings, SPARES program coding and logic, as well as the MCD collection system, must be reviewed before SPARES is implemented in the SBSS.

Title: *Effect of Work Attitudes on Performance Within TAC Base Supply Organizations*

Author: Capt Stephen J. Eichenbrenner

This research sought to evaluate the effect of work attitudes and rewards on the performance of TAC base-level supply personnel. The research, which used a survey instrument to examine a cross section of all enlisted employees assigned to various positions within TAC supply, had four major objectives: (1) test three causal hypotheses through path analysis; (2) determine if individuals in customer service positions are significantly different from those who are not supporting customers; (3) identify opportunities available to supply managers for improving their organizations; and (4) provide a benchmark for future work attitude evaluations. Path analysis revealed support for performance as a predictor of satisfaction and commitment, but not vice versa. Rewards were not found to have much of an effect on performance, but were found to affect satisfaction. Organizational commitment was found to have the greatest influence on performance. The only difference between the two groups of employees lay within their response to intrinsic reward satisfaction for customer service efforts. Recommendations were subsequently offered to supply managers and suggestions for future research were given.

Title: *Analysis of the Cash Recovery Rate's Potential Application in Determining the Social Cost of Capital*

Author: Capt Francis J. Geiser, III

This study explored the potential application of the cash recovery rate in determining the social cost of capital. It specifically investigated the results of using cash recovery rate-based, internal rate of return (IRR) estimating relationships, formulated under assumptions of constant investment growth rate, to estimate IRRs for simulated firm-level financial data generated using both exponentially increasing and sinusoidal investment growth rates. An extensive literature review builds an analytical link between the need for updating the social discount rate, capital budgeting decisions based on IRRs, and the proposed behavior of the cash recovery rate as a surrogate for the IRR. Analysis of the estimated IRRs, based on an algorithm developed by the author, indicates the relationships remain valid under the more complex growth rate patterns. This result further supports the use of cash recovery rates as a means of measuring firm profitability and also strengthens the case for additional research into applying an opportunity cost of capital approach for the selection of a social discount rate based on a nationally averaged internal rate of return.

(NOTE: Capt Harkenrider also received this award for the thesis described under AFIT Commandant's Award.)

George K. Dimitroff Award

(Most significant contribution to major USAF civil engineering issues)

Title: *An Expert System Solution for the Quantitative Condition Assessment of Electrical Distribution Systems in the United States Air Force*

Author: Capt David O. Paine

Faced with a rapidly decreasing budget, the Air Force is in need of a method to objectively evaluate its aging utility infrastructure assets. Such an objective evaluation could be used to compare similar facility infrastructure systems, including the identification of possible problem areas and the prioritization of major repair projects. This thesis developed a component model which can be used to objectively evaluate a typical electrical distribution system. The Delphi process was used to gather expert opinions in three areas: (1) those critical components which should be included in the model, (2) the relative importance of each selected critical component, and (3) the criteria used to evaluate each of the selected critical components. The model assigns a numerical rating from 0 to 100 to each critical component. The indices are then combined using a relative weighting scheme to arrive at the overall electrical distribution system condition index. The model, which determines component and system condition indices based on user input or available database information, was encoded into a computer-based expert system shell to provide a smooth user interface and easy update capabilities.

National Contract Management Association (NCMA) Award

(Significant contribution to contract management techniques)

Title: *Cultural Dimensions of International Business*

Author: Capt Anthony L. Amadeo

The purposes of this study were to identify cultural factors which impede international business in private and public programs and to emphasize the effects of these cultural factors in the international environment. The study, which focuses on the areas of international program management and negotiations, was designed to be an informative guide which program management and contracting professionals could use to increase

awareness concerning cultural differences and the resulting barriers. The study also identified lessons learned to help effectively deal with those cultural barriers.

Title: *An Analysis of Procurement Lead Time for Repairable Spares Within the Air Force Logistics Command*

Author: Capt Patricia M. Norman

As part of a larger process to define and model the logistics pipeline, this research focused on the acquisition subsystem and, within that subsystem, on variations in procurement lead time for repairable spares. Knowing both the length and variation in procurement lead times is vitally important for accurate prediction of these times. Inaccurate prediction of lead times may result in spares being ordered too early or too late, either wasting resources or adversely impacting mission requirements. Therefore, the study identified the key components of procurement lead time within AFLC and examined factors that may have significant influences on those lead times. Procurement lead time was divided into administrative and production lead times. Administrative lead time was further divided into precontract and contract administrative lead time. Analysis of variance models was used to test the possible effects of product type, dollar amount of the contract, whether the award was competitive or not, which ALC was involved in the procurement, and the type of contract used.

National Estimating Society Award

(Significant contribution to cost analysis, cost estimating or contract pricing)

Title: *A Model for Estimating Aircraft Recoverable Spares Annual Costs*

Author: Capt Philip L. Redding

This thesis developed a background reference document concerning recoverable spares cost estimating, evaluated a representative sample of existing spares cost models, and developed a model for estimating annual replenishment spares costs using aircraft physical and performance characteristics. The two-part model involved first developing a condemnations cost estimating relationship (CER) and then developing both a CER and spreadsheet generated factors which related condemnation to replenishment spares costs.

Best Article Written by a Junior Officer

The Executive Board of the Society of Logistics Engineers (SOLE) Chapter, Montgomery, Alabama, has selected "Reduction of the Recoverable Pipeline" (Summer 1991), written by Captain Bradley Silver, USAF, as the best *AFJL* article written by a junior officer for FY91.

The Problems With Logistics Data . . .

Dr Bruce P. Christensen

Introduction to Data

When you stop to think about it, the word "data" is one of the most troublesome words in the English language. Is it, "The data are . . ."? Or is it, "The data is . . ."? Whichever it is, the word is misused by nearly everyone. And the experts who write the dictionary do not solve the problem for us. They say it is a plural noun meaning information which is used for reasoning and to aid in decision making. They also refer to the word as the plural of datum.

Data is the plural of the Latin word datum (something given) and traditionally takes a plural verb: These data are inconclusive. It is now widely used also with a singular verb: This data is inconclusive. The Usage Panel accepts the singular construction in casual speech but is evenly divided on its acceptability in writing. (5:366)

That conflict, even among those who sit on the English Language Usage Panel, causes "data" to be one of the most grammatically misused words in the English language. But enough already. This is not meant to be a lesson in the King's English. You see, there is more to the trouble than the mere usage of the word in speech or writing. I am referring to the gross misuse of data.

Years ago, Disraeli wrote, "There are three kinds of lies: lies, damned lies, and statistics." (2:109) Now we begin to see more of the problem with data. But, that is not all. The conclusions often reached as a result of data study can certainly be no better than the reliability of the data source. Yes, data is/are a problem. The problem with the word usage will have to be settled on some other turf. Herein we can only hope to clarify some of the other problems that we tend to experience with data in the logistics business. To help understand those problems, it will be beneficial if one merely thinks of data as information—for information about a product, service, process, or person is referred to as data. (4:78)

Information

When thinking of information, one does not typically limit the thinking to data in the numerical context and that is very important. As was already stated, data means information. Similarly, then, information can and does also mean data. In that context, data, or information, can take on one of two very important forms.

The first shall be referred to as the descriptive or narrative form. Here the information is written using an accepted language medium such as English, French, German, Spanish, etc. This form of information is typically used in technical orders and maintenance or supply manuals. It is this kind of information which provides instruction about a process such as packaging and handling a product. This type of information describes characteristics, phenomena, processes, and results of activities. Generally, one finds the descriptive or narrative form of

information expressed in words although it is not restricted to words alone.

Some descriptive information is easily transformed numerically. This is often referred to as categorical information. All of us are familiar with this procedure and have been performing it since we were young children barely old enough to play childhood games. We would line up as children having names, Jane, Vicki, Tom, David, etc., and then count off by twos so we fit into a category of being a one or a two. The same principles apply in the logistics world but on a different scale.

For example, we may wish to organize and divide our supply warehouses so that like items are, first, placed in the same category and, second, stored in the same location. This may facilitate ease of receipt, handling, order picking, distribution, inventorying, and all other warehousing functions. Those locations could easily be numbered 1, 2, 3, etc. And, we have successfully transformed descriptive information, east south-east portion of the Campbell Warehouse (Building 1139), into numerical information, location number 6.

Another formal name for descriptive information is "attribute data." (4:78) In most quality and statistical works, one will often see the terms "categorical variables" and "attribute variables" used interchangeably.

The other major category of information is referred to as variables information. As one can readily imagine, this type of information arises

. . . from (1) the measurement of a characteristic of a product, service, or process; and from (2) the computation of a numerical value from two or more measurements of variables data. (4:80)

In the first case, we are making some precise measurement of a characteristic, the values of which are variable; that is, there are a large number of potential values the characteristic may take on when we observe that characteristic. We may be interested in measuring the Tactical Fighter Wing's (TFW) not mission capable due to supply (NMCS) rate.

The second case is most easily understood through a practical example. In the transportation business, one will often take measurements on the number of miles driven between gasoline fill-ups and on the quantity of gasoline required by the various vehicles in the fleet when they are filled with gasoline. (By-the-way, both of these are measurements of case (1) mentioned.) Combining the two pieces of information learned when the process was measured can help one know the miles per gallon (MPG) achieved for each and every vehicle owned. It is the calculated MPG which has been numerically derived from two measurements of variables data.

So what? What is the significance of this diatribe on data? Hopefully, those questions will be answered momentarily; but for now, suffice it to say that data is much more than the 0s and 1s placed in an electronic digital computer representing numbers only. It also includes descriptive material the logistician relies so heavily upon to accomplish a job, whether purely descriptive or descriptive made categorical.

Why Have Logistics Information (Data)?

In the world of logistics, we are constantly bombarded with data or the need therefor. A few examples are Logistics Support

Analysis Records (LSAR); specifications; statistical data such as mean time between failure (MTBF), reliability, repair times, flying time, supply support, maintenance times, number of personnel, and percent of base repair; and administrative data such as accounting records, vacation status, and, of course, pay records. All are important to the logistics business. Why?

The answer to that question should be quite clear and yet it often becomes obfuscated for one reason or another. Contrary to the feelings of many logistics students, a plethora of data is not an attempt to satisfy the insatiable hunger of quantoid analysts. The logistics business requires information to get the job done. However, that may not be entirely true. It has frequently been jokingly stated that given enough bananas, a monkey could learn how to be a pilot. If one is only concerned with getting the job done, perhaps monkeys could be trained to perform logistics functions.

But that is not enough. A logistician should be concerned with the "seven rights" of logistics or some other appropriate objective function. That implies some sort of basis for each and every action taken. Part of that basis for action is the assimilation of information. In short, then, information is essential to aid the logistics manager in the decision-making process.

A natural extension in the grand scheme is to help improve the logistics processes themselves. A lot has been written of late on something called Total Quality Management (TQM). Although there are many interpretations as to precisely what that means, at least one perspective put forth is continual process improvement through the reduction of variation. That cannot be accomplished without information. Sound management decisions and continual process improvement are not likely to be achieved in the absence of historical information, otherwise known as data.

Problems

Now someone will say: "But we have plenty of data, we need no more. Our computers and storage rooms are full." That is a pretty sound argument for putting a crunch on the quantoid analysts and their need for more. There is even legitimacy for this being the first of several problems with logistics information. However, that problem is simply a specious argument for cutting back. The real truth emerges in other problems with data.

The exact opposite could logically be offered as the second problem, too little data. Anyone that is involved with technical manuals would heartily argue against that. It is difficult to get a rewrite of any technical data that does not grow in volume. Other sorts of data, whether descriptive or numerical, would also be suspect because there is a tendency to collect every bit of information we can collect.

Navy Rear Admiral Guy Curtis spoke recently in an interview with Society of Logistics Engineers personnel where he directly addressed both of these problems as they pertain to the plight of technical data within DOD acquisition circles. "Sometimes we don't have it and we have to create it and sometimes we have it and we have to improve upon it." (1:1) It would appear that no matter which problem is argued, too much or too little data, it can legitimately be supported.

But, how usable is that information which we do have? That is the third problem. Perhaps there is plenty of data available on every logistics topic that one could conceive; but, if that information is not in a usable format, it is not of any value. The storage and retrieval systems employed with this data are often the culprits that render such information useless, but they are not alone guilty. Sometimes the analysts must share the blame.

There are several reasons why that which the quantoids provide fails in management acceptance. James R. Evans and others summarize those reasons:

- (1) The expectations of the manager and analyst differ.
- (2) Existing limitations in building mathematical models.
- (3) Time constraints to arrive at satisfactory solutions.
- (4) The dynamic environment in which decisions are made.
- (5) Resistance to change on the part of traditional managers.
- (6) Preconceived solutions by both the managers and analysts. (3:30)

So whether we have too much or too little is a mute point. The big question is usability of that which we have and that which we accumulate in the future.

Closely related to the realm of usability is that of the next data problem, accuracy. Accurate decisions can be developed by chance, but they are much more likely to be made if the information upon which those decisions are based is accurate and complete. There is an old adage that if individuals ask the right question of the wrong person, or the wrong question of either the right or the wrong person, they are extremely unlikely to get the right answer. The only possibility with much promise is to ask the right question of the right person. That is accuracy of data in a nutshell.

Implied in the accuracy/completeness problem is the correct measurement of the correct process. Quality literature refers to it as the operational definition problem. Each process must be appropriately defined in an operational context and the method of appraisal precisely delineated including how it is to be measured, the device used, if pertinent, the periodicity, and the recording of the assessment.

Once accurate and complete information is available, the logistics analysts stand a better chance of overcoming the barriers to management acceptance already mentioned. Those trained in analysis cannot remove any personal bias they may have regarding a particular piece of data, but they are much more likely to provide a real analytical response to the data. That response will support a more competent basis for the decisions faced in day-to-day logistics challenges.

Conclusion

The nature of logistics demands data—data of a varied character depending upon the specifics of the logistics function. Many logisticians have often said that those who do not know history are doomed to relive it. Data/information is a very real part of helping today's managers understand history and provide the sound basis necessary to invoke more informed decisions.

That means we need to overcome the problems faced with accumulating logistics information. Only then will we be able to make those more informed decisions. Only then will we be able to reduce and eliminate negative sources of process variation. Only then will we be able to do the right job right.

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